The Electrical Industry's Weekly Magazine

December 2, 1957

Electrical World

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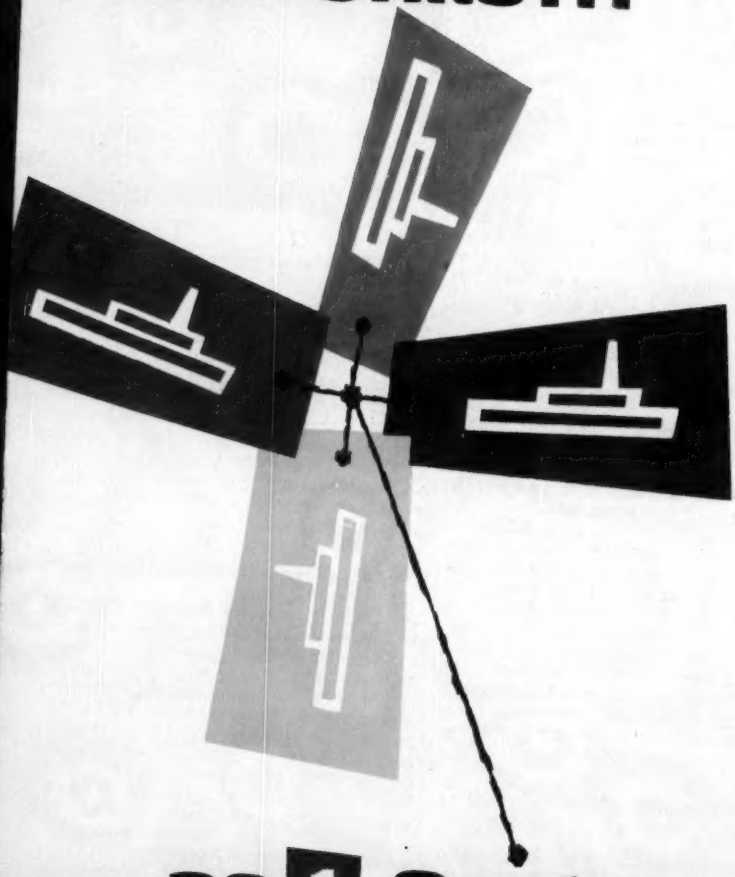
4 Utilities Plan New Units...



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B POWER GS W L
ERSITY MICROFILMS IN
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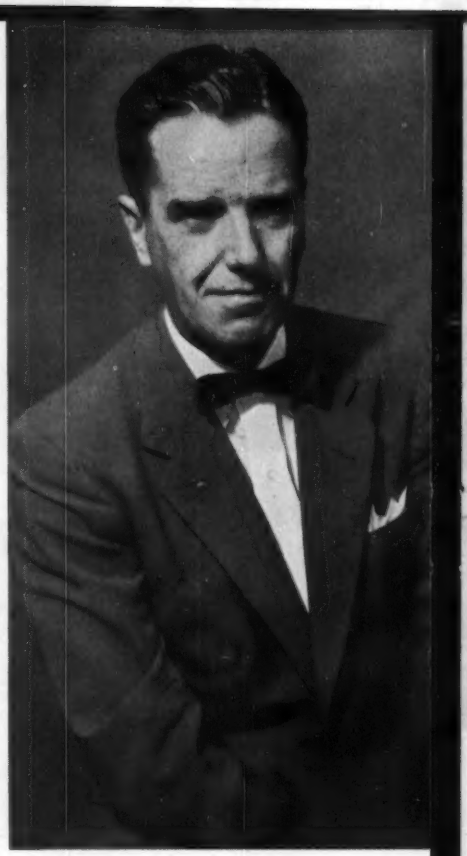
Interview with General Electric's

JOSEPH T. BAILEY

General Manager–Outdoor Lighting Department

Highway program offers utilities new lighting opportunities



Q How much new highway mileage will be lighted?

A There are 41 thousand miles in the planned National System of Interstate and Defense Highways. Ideally, every mile should be illuminated for maximum driver comfort and safety. But the current estimates lead us to expect about 7% of the new highway mileage—primarily in urban areas—will be lighted.

Q What are the areas to be lighted?

A We expect there will be fixed illumination on the seven *critical* areas: (1) interchanges and intersections, (2) entrance and exit ramps, (3) areas of traffic convergence or divergence, (4) bridges and viaducts, (5) tunnels and underpasses, (6) highway guide signs, and (7) continuous lighting within urban areas and heavily traveled stretches where interchanges are less than about one mile apart.

Q What will this cost?

A The average motorist will pay about $9 per year more than he is paying now for these 41,000 miles. This Federal amount will be raised through increased gasoline and tire taxes. Only 4-9 cents of this amount per year will go toward lighting approximately 7% of the mileage.

Q Since these highways won't be completed until about 1969, won't the lighting costs be higher by then?

A I don't think so. This chart (reproduced below) shows how the useful footcandle of illumination has increased per dollar of expense. This has been due to lamp improvements, wiring and cable improvements and to more and more efficient luminaires. We've been offsetting the effects of inflation through research activities at General Electric. With continued refinement in design and manufacturing techniques we expect to continue keeping lighting costs down. This greater lighting economy, coupled with increased traffic on our highways, will hasten the day when every necessary mile of road is adequately illuminated.

We know that, speaking conservatively, adequate lighting on our present roads can save 10,000 lives annually, for one study alone has shown that at 28 locations, the average fatality rate for the year following lighting was 68% below that of the year preceding lighting.

Q Where does the electric utility industry stand in this matter of highway lighting?

A I can't of course, answer that. But I can describe how we, as a manufacturer, have worked with utilities in the past and how we would like to team up with them on the highway program.

Traditionally, utilities have offered a complete street-lighting package to their customers: one, equipment and installation; two, maintenance; three, energy.

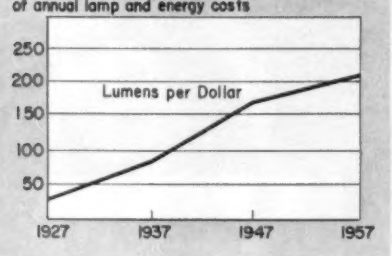
Utilities may wish to offer maintenance and energy as separate services to their highway department customers. Because of the scope of this program, utilities may be called upon to maintain lighting equipment at a greatly expanded rate, and farsighted companies are preparing now to offer this service.

Q How else will utilities be asked to participate?

A No doubt the utility will be asked to provide application and design advice or assistance. Highway departments or consulting engineers may turn to the lighting experience which the utilities have built up over the years and seek help in planning highway lighting systems of the best design at minimum cost. We are prepared at General Electric to reinforce the utilities' know-how with our manufacturing and research experience. Our demonstration streets, our highway lighting conferences, and the engineering assistance we can make available are examples of our efforts in this area.

MORE ROADWAY LIGHT PER DOLLAR

Lumens on roadway per dollar of annual lamp and energy costs



Q Will the highway program appreciably affect load?

A This program—by all standards of measurement—is the greatest peacetime construction project the world has ever known. We have not yet, of course, begun to feel the real impact of the mammoth undertaking on residential, commercial, and industrial loads. Even before many of these changes occur, additional loads will come from suppliers of cement, asphalt, etc.—who will have to double output by the mid-60's.

Q But lighting will be the earliest load?

A Undoubtedly, yes. Roadway lighting will mean greater driving comfort, safer travel, and larger night-time roadway capacity.

The various state highway departments are carrying a heavy burden of responsibility to design a highway system that will be a credit to the nation now and in 1975. It is not only good business but also good public relations for the utility industry and manufacturers to give this program our active support. To do this, we must call on every development that modern technology can produce to make better, safer, well-lighted highways.

For further information on lighting our new highways, write to General Electric, Section 301-368, Schenectady, N. Y.

MORE POWER TO AMERICA

GENERAL ELECTRIC

Electrical World

Vol. 148, No. 23 December 2, 1957

Published for 83 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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Soggy land and heavy reels of Okonite Cable presented a rugged installation problem. But by digging a 4-foot trench, and by "putting the Cat before the truck before the float," Guarantee Electrical Co. laid down two cables simultaneously at three miles per hour. Cables were a 15kv, 3-conductor Okolite-Okoprene submarine power cable and a 24-conductor Okolite-Okoprene submarine control cable designed to assure the continuous water supply essential to plant operation.

"We specified Okonite because...

This tough installation called for top-quality cables to assure continuous plant operation"

"Demanding assignments are 'our meat'," says Arthur Kaspar, Chief Electrical Engineer of Guarantee Electrical Company of St. Louis. "A good example is our recent cable installation for a large plant here in Missouri.

"Our client specified a never-failing, 24-hour-a-day, controlled source of plant water. The best pumping station site was miles from the plant, in low-water marsh land subject to periodic flooding from the Mississippi River—up to 25 feet above river level. One thing was certain... this called for really dependable cables for power and for control of the complex pumping station that would supply the water to the plant.

"Another thing was certain, too ... this was a job for Okonite. Our experience has taught us that Okonite gives maximum insurance and value where dependability in vital circuits is concerned."

Conferences between Mr. Kaspar and Okonite developed the proper cables: unaffected by water, highly resistant to soil conditions and other factors that attack *any* buried or submerged cable, and backed up by Okonite's 78 years of making highest-quality cable.

* * *

For your vital circuits, take a tip from Mr. Kaspar and other leading electrical engineers and specify Okonite. Whatever the installation, when you talk to Okonite you'll get an unprejudiced recommendation for your cable needs because Okonite, *and only Okonite*, makes cable by all four insulating methods: strip, dip, extrusion and taping. The Okonite Company, Passaic, New Jersey.

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. . . *from the publisher*

Memo to the Boss:

In just 8 weeks Electrical World will publish its 54th annual statistical report—with your cooperation.

At this moment we are buried in a flood of survey returns. As usual, most are from loyal supporters who annually seize this opportunity to dramatize the endless vitality of the electric utility industry. We know these people; their names are in our files from earlier surveys. To them we are deeply grateful.

But there are utilities that we have yet to hear from. Some may feel their expenditures are too small to make a difference.

Nothing could be farther from the truth. Just as nickels and dimes add to dollars, so do hundreds and thousands add to millions. These are the "nickels and dimes" we want to hear about.

Results of this annual survey serve as a guideline for both utilities and manufacturers in their planning and operation.

Our questionnaire, now on your desk, is designed to take a minimum of your time. If certain data is not readily available, or if next year's plans haven't been firmed up, let's have your best estimate for both years. We'll look forward to hearing from you.

Fischer Black

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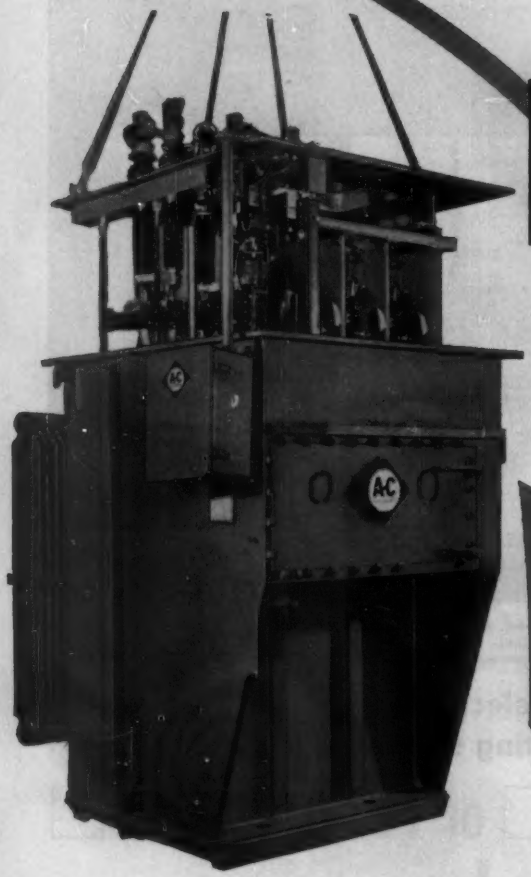

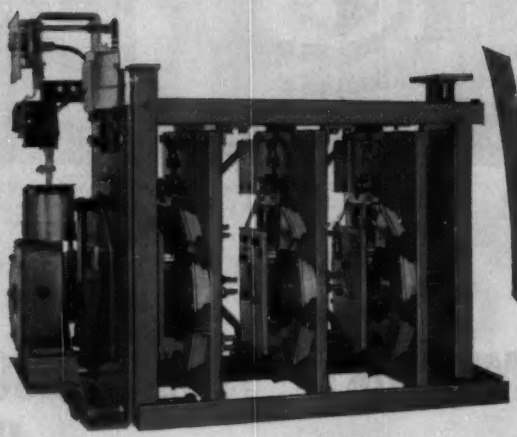

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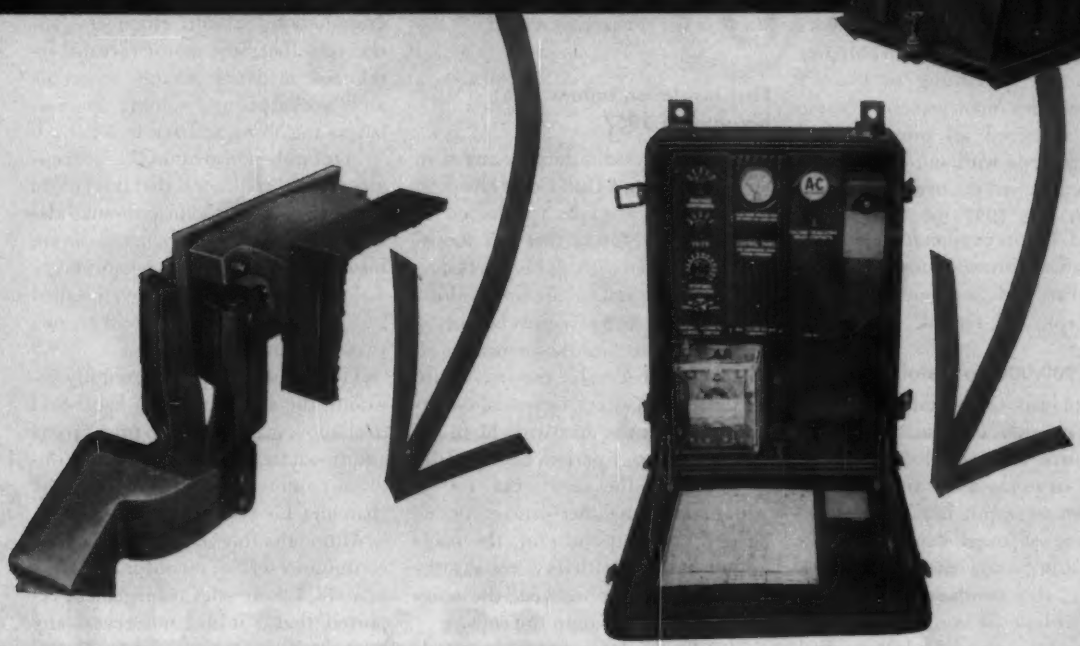
3-phase regulators



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ALLIS-CHALMERS

Fabri-Seal Insulation Failure Investigated

Introduced by Elliott in 1948. Achieved 8-year field service record. First failure occurred in 1957. Causes investigated by Elliott engineers.

The Elliott Company, which takes pride in the service record of its stator coil insulation for large induction motors, had some explaining to do this fall when its much-publicized Fabri-Seal insulation experienced its first failure.

Fabri-Seal insulation was introduced in 1948, installed in motors serving utilities and industries all over the country. According to Elliott's Ridgway sales management, "these motors shattered all previous field service records with not one insulation breakdown in over 8 years." Then in late 1957 the first failure occurred. Elliott engineers were quick to launch an investigation to determine what had happened to spoil such a splendid record.

Over 1,900,000 hp installed

An analysis of the tabulated field service records confirm that since 1948 more than 1,900,000 hp of Elliott's large motors with Fabri-Seal insulation were put into service and that none of them experienced an insulation breakdown in nearly 9 years.

Briefly, this insulation system includes sealing of coil slot sections with hand-wrapped Mylar*-backed mica, plastic-sealing at vulnerable points, vacuum preconditioning and pressure impregnation, turn-to-turn testing at high surge voltages, immersion of the complete stator in insulating varnish and subsequent baking. Obviously, it also involves new materials and fabrication methods, as well as thousands of man-hours tabulating and analyzing accelerated life-testing of hundreds of insulation systems.

Not one electrical failure in over 8 years

The fact that not one of these machines experienced an insulation failure in over 8 years was prominently exploited in literature, advertisements and in personal contacts. At the height of this promotion the first Fabri-Seal insulation failure occurred. After recovering from the initial shock, the sales management was quick to point out—and rightly so—that a failure had to happen sooner or later and that this did not in any way nullify the 8-year field service record.

First insulation failure occurred in 1957

The insulation failure occurred in a motor serving a Gulf Coast chemical plant. Elliott engineers hastened to the scene and found that the atmosphere was laden with highly-corrosive, hygroscopic magnesium chloride dust.

When this corrosive dust blanketed the winding, it absorbed moisture to an almost unbelievable extent. Failure occurred right after a torrential downpour deluged the area with 11 in. of rain in a 24-hour period, bringing the humidity in the area near 100%. Although the weather-protecting enclosure kept out the rain, the magnesium chloride with its water-absorbing action literally "sucked" the moisture out of the air onto the coils.

"In effect," the engineers reported, "the motor has been operating in a brine solution, practically the equivalent of being submerged. Furthermore, the corrosive dust had attacked the paint, steel baffles, and even brass name plates."

It must be said, however, that at no time did the Elliott engineers blame the failure on the severity of the operating conditions. At the same time, they were still not convinced that Fabri-Seal insulation was at fault. In their opinion, Fabri-Seal coil insulation *simply would not fail*—even in such highly-corrosive and moist atmospheres.

How Elliott engineers solved the problem

With the customer's permission, the motor was returned to the factory for further investigation. After careful examination, Elliott engineers announced that "the motor revealed irrefutable evidence of faulty materials and workmanship,"—quite an embarrassing thing to have to admit.

"Our only consolation," Elliott engineers reported," was that this failure occurred in what our customer described as 'the world's most severe insulation application' where every major make of motor has been installed . . . and has failed in less than one year of operation."

The Elliott Company promptly rewound the stator coil with Fabri-Seal insulation, gave all mechanical parts additional treatment for corrosive conditions and returned the motor to the customer for service.

Although this failure broke the continuous service record that started in 1948, Elliott sales management reported that, "it did not reveal any basic weakness in the Fabri-Seal Insulation System."

Elliott's continuous insulation research

Even while Elliott Fabri-Seal insulation was establishing the 8-year field service record, Elliott engineers were busy life-testing a new Super-Fabri-Seal insulation. The results of these tests forecast a new era in large motor service life. They were made over a period of nine years, are now being tabulated and complete details will be released at an early date.

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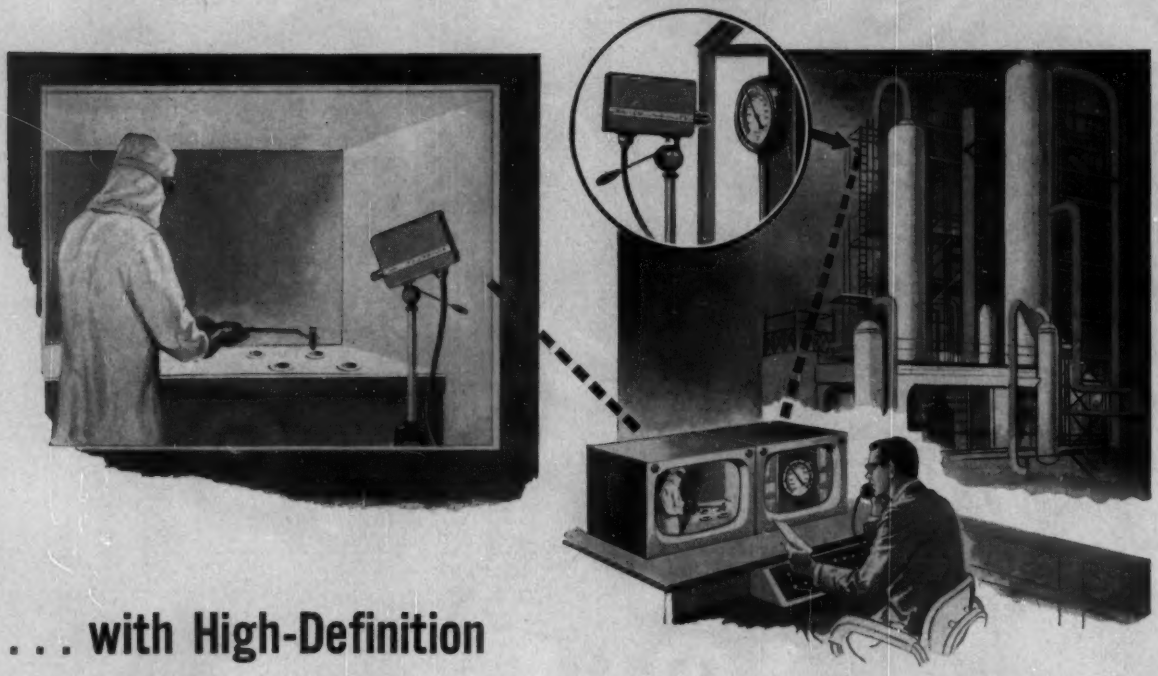

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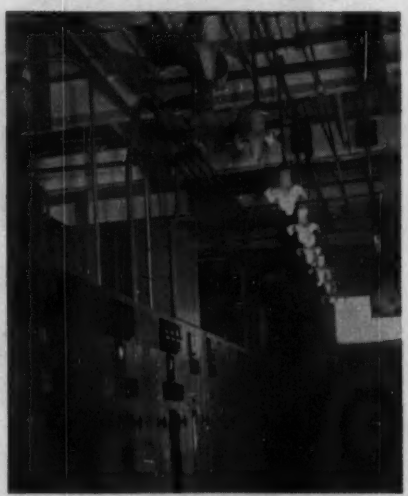

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When multiple fuels are to be burned in a steam generating unit, one of the problems to overcome is the variation of steam temperature with the different fuels.

Design Based on Worst Coal That Can Be Anticipated

In designing and engineering a unit in which gas, oil and coal are to be burned, the amount of furnace heating surface supplied depends upon the slagging characteristics of the coal. If the coal to be used has a minimum ash softening temperature of 2100 F., in order to avoid objectionable slagging, the unit must be designed so that the furnace exit gas temperature will be approximately 100 degrees less than the ash softening temperature, or 2000 F.

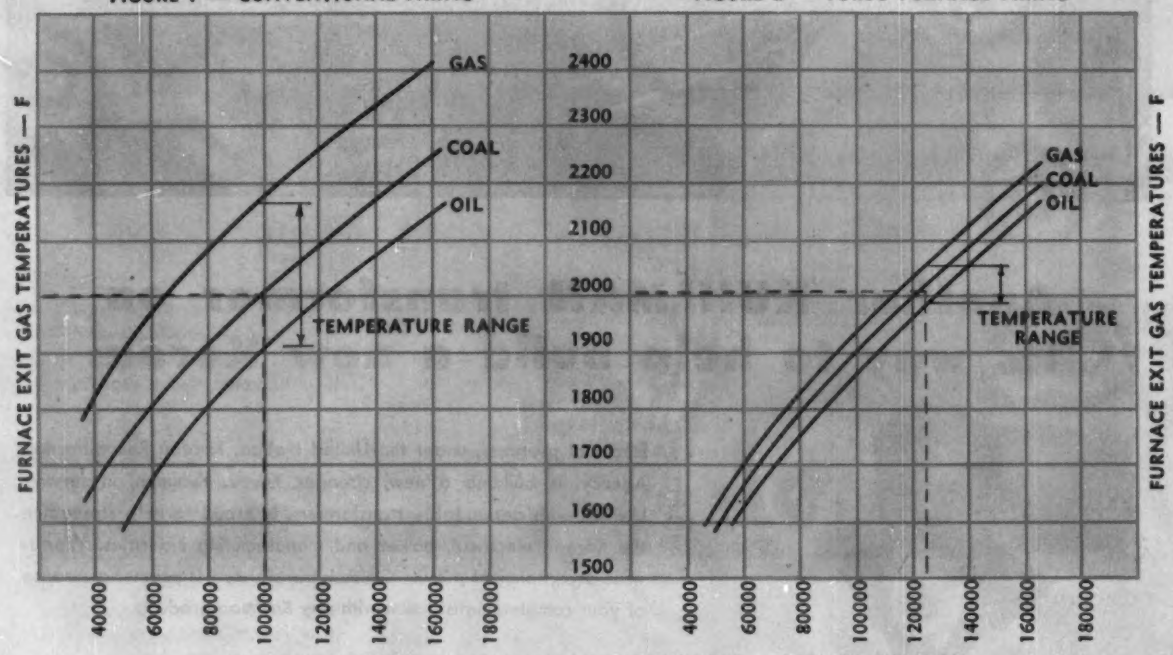
Conventional Units Need Extensive Steam Temperature Controls

When natural gas is burned in a conventional unit designed for coal with an ash softening temperature of 2100 F., the exit temperature would rise to approximately 2165 F. (Fig. 1) resulting in higher steam temperature than desired.

FURNACE TEMPERATURES

FIGURE 1 — CONVENTIONAL FIRING

FIGURE 2 — TURBO FURNACE FIRING

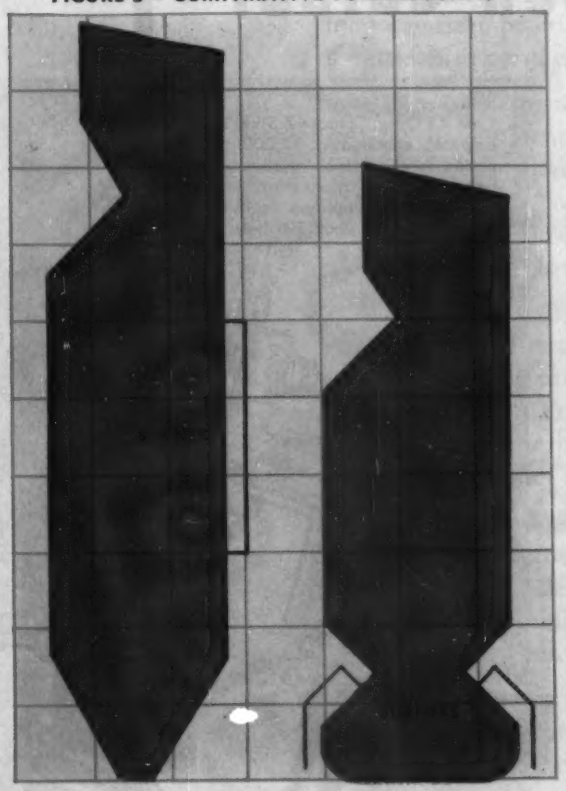


When oil is burned in a conventional unit burning this coal the exit temperature would drop to 1900 F. resulting in a lower steam temperature than desired. Extensive means to control steam temperature must be provided to overcome this variation in steam temperatures.

The Ideal Design for Multiple Fuels

The ideal design of a multiple fuel unit would be one which would produce the same furnace exit gas temperature regardless of the fuel burned. Figure (2) shows the exit gas temperature curves from a Riley Turbo Furnace unit. Note the material reduction in temperature variation with the different fuels. This relative similarity in exit temperatures reduces the problem of steam temperature control to a minimum, and makes it possible to carry approximately the same constant steam temperature range with all fuels.

FIGURE 3 – COMPARATIVE FURNACE SIZES



CONVENTIONAL FURNACE TURBO FURNACE

Uniform Furnace Exit Temperatures

Relatively uniform exit temperatures with all three fuels, when fired in a Riley Turbo Furnace unit, result from the burning of the fuels in the bottom of the unit. Combustion is substantially completed within the confines of the furnace bottom, and with this design, gas burns with a luminous flame. These operating characteristics result in a lower furnace exit temperature with a given heat release per square foot of effective radiant surface.

Overall Unit Size Reduced

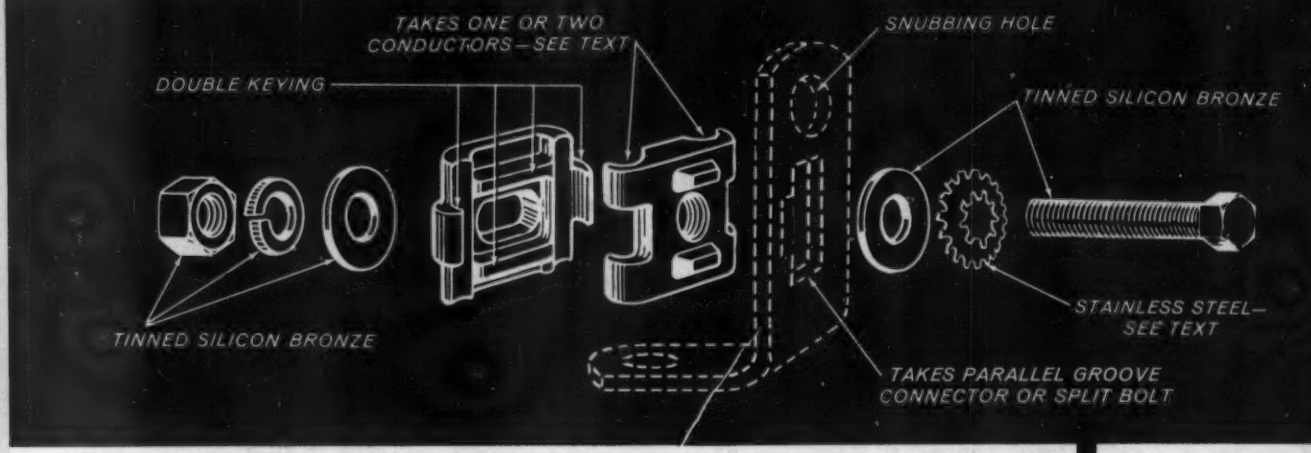
To obtain a low furnace exit temperature of 2000 F. with a conventional unit, (Fig. 1), it is necessary to design the unit with a heat release of 98,000 b.t.u. per sq. ft. of effective heating surface. With a Riley Turbo Furnace unit, to obtain this same furnace exit temperature, this furnace heat release would be 122,000 b.t.u. (Fig. 2). This results in an appreciably lower unit, see Fig. (3), another of the many advantages of the Riley Turbo Furnace.

Clean Heating Surfaces

A relatively high temperature is obtained in the Turbo Furnace bottom resulting in rapid and complete combustion. The burners, arranged for opposed firing, produce a uniform distribution of heat without the intense heat zones at the core of the flames that occur with conventional burners. There is no impingement of flame or slag on furnace walls. Heating surfaces stay clean.

A Riley engineer will gladly give you complete information about this latest Riley development. Write — Boiler Engineering; Riley Stoker Corporation, Worcester, Massachusetts.

RILEY
STEAM GENERATING & FUEL BURNING EQUIPMENT



now! parallel groove connectors on S&C's Open Cutout

If you're coming into a cutout with aluminum, chances are you will want a parallel groove connector. With S&C's Type XS Open Cutout you can have this feature at no charge.

Expressly designed for use with aluminum conductors, this new parallel groove connector has an unusually large gripping area. The connector halves are doubly keyed to each other, insuring uniform gripping of conductor, regardless of size. The connector takes one or two aluminum conductors—copper too, of course—up to 2/0 stranded or 1/0 ACSR.

Making connections is easy. Connector halves are keyed to each other and to the cutout to prevent rotation. You need only one wrench to make up the connectors, since a stainless steel internal-external tooth lockwasher holds the connector body mounting bolt against turning. And, for each tightening of the connector with lineman's tools, there is a generous size nut—5/8" across flats.

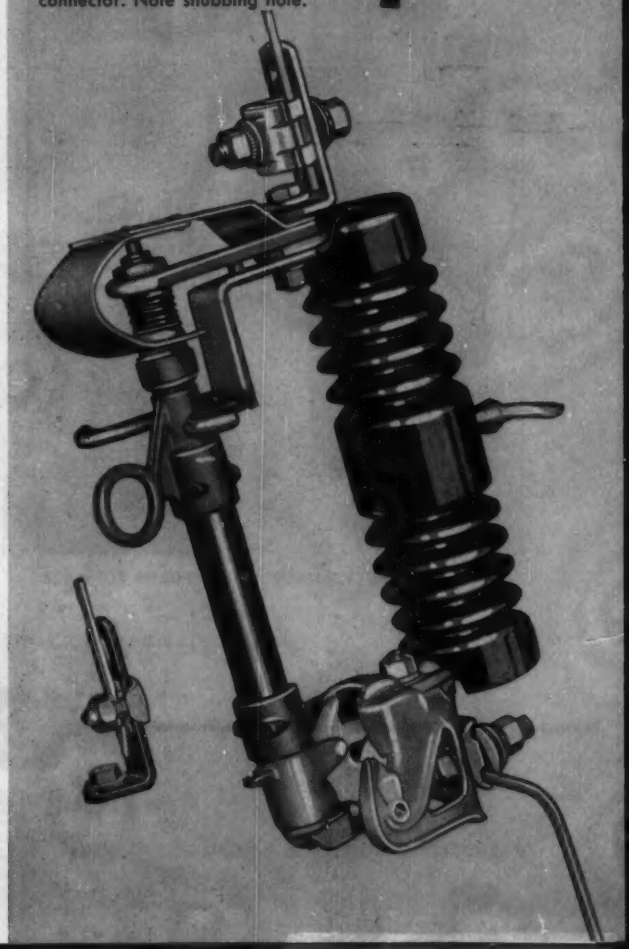
Larger parallel groove connectors are available at slight charge. These connectors accommodate one or two conductors, from No. 2 solid aluminum (or copper) to 4/0 standard aluminum, copper, or ACSR.

As an optional standard the split-bolt connector is available at no extra charge. Maximum conductor size is No. 1 stranded—copper or aluminum.

S&C Electric Company, 4421 Ravenswood Ave., Chicago 40, Ill. In Canada: S&C Electric Canada, Ltd., 8 Vansco Road, Toronto 14, Ont.

S&C ELECTRIC COMPANY

Type XS Open Cutout—7.5 kv, 100 amperes continuous, 12,000 amperes interrupting—shown with parallel groove connectors. Insert (below) shows optional split-bolt connector. Note snubbing hole.



NEWS-SCOPE

FUTURE NEWS ▶ **Bills for TVA self-financing will be taken up early** in the next **session** of Congress. Reason: Proponents argue the plan will allow more funds for defense without raising the federal budget.

Look for proponents of the Gore bill (the plan to have federal government build large nuclear power plants) to use the current discussion for an enlarged defense program as a reason for an acceleration of nuclear power development.

LATE NEWS ▶ **Direct conversion of heat into electricity with efficiency of 8%** has been attained with a new thermionic converter invented by Dr. Volney C. Wilson of GE Research Labs. The converter is a tube-like device with two electrodes maintained at high, but different temperatures. The hot electrode emits electrons; the cold one collects them. Space charge effect is neutralized by positive ionization of the gas, maintained by heat from the "emitter." Wilson's laboratory model, a long way from practical application, produced ½ watt at 0.8 volts or 3 watts per sq cm of electrode surface. Efficiency of 30% is sought.

The U. S. is leading the world "with the most comprehensive program for the development of atomic power," declares AEC Chief Lewis Strauss at dedication of privately financed Vallecitos atomic power plant. He added, "Within a few weeks, the large-scale Shippingport plant will come 'on line.'" But Adm H. G. Rickover said recently Shippingport will become critical sometime this month. He made no mention of when it would go into commercial operation.

An "unfavorable trend in operating income" is shown in study soon to be released of earnings results of electric utilities for first nine months of 1957. Truslow Hyde of Josephthal & Co prepared the study, which indicates it will be necessary for more utilities to increase rates to offset rising operating ratio.

U. S. should lead the free world in creating a pool of knowledge on design and construction of industrial power reactors and controlled thermonuclear reactions, suggests Thomas Murray. The former AEC commissioner said the need for secrecy on nuclear technology has been drastically reduced by Soviet advances.

The power situation in the Northwest would be aggravated by further postponement of an FPC license for Pacific Northwest Power's Mountain Sheep-Pleasant Valley hydro project, said PNP at last week's hearings. It said no alternative project is available at present. The hearings are last step before a decision by the commission.

Congratulations . . . Cincinnati Gas & Electric elects Ernest S. Fields president and chief executive officer. William H. Zimmer becomes executive VP, treasurer, and finance committee chairman. Three new VP's at Utah Power & Light are P. A. Blanchard, VP-engineering, construction, and power production; D. L. Broussard, VP-financing and secretary; and T. C. Woodside, who remains treasurer.

ELECTRICAL WEEK

A TWO-MINUTE

EVENTS ▶ **A fund-raising campaign for the proposed $10-million** United Engineering Center in New York has begun. The 20-story building is to become headquarters for 16 national engineering societies **(p 53)** . . . International Lighting Competition receives 143 utility entries out of 377 total. First prizes go to San Diego G&E, Wisconsin Electric Power, Detroit Ed, and Arizona PS **(p 50)** . . . A re-examination of the U.S. civilian atomic power program has begun and promises to aggravate political activity in this field **(p 53).**

MANAGEMENT ▶ **A frontal attack against operating costs** will make its first "breakthrough" this month for four Connecticut utilities who have laid aside individual interests for the good of the group. New Bridgeport Harbor Unit No. 1 is about to go into service—the first machine to do so under a joint capacity-planning program of the four utilities. From now on, future units will be planned and situated in the area as if all four companies comprised one system. Larger units will be installed with companies sharing the costs and economies on a "participation" basis. To reduce costs further, existing transmission lines of one company may be used to feed loads of another company. This plan is Connecticut's answer to the cost problem often facing small companies that have no real need for "large economy-size" generators **(p 58).**

GENERATION ▶ **What made the big rotor burst?** The Pittsburg Station machine had cleared factory tests and put in 20 months of satisfactory duty. The answers have been found in obscure characteristics of ultrasonic flaw-finding techniques, and in a disparity in performance of small disks used to represent rotors in laboratory tests and the performance of the rotors themselves. Furthermore it has been learned that the nickel-molybdenum-vanadium steel alloy, now widely used for rotors, can be improved to reduce its susceptability to failures. This can be done through modification of the alloy content and heat-treatment techniques. Out of an intensive investigation into the cause of rotor failures has come the recommendation that rotors be operated at the highest practicable temperatures, and that cold rotors not be brought up to full speed especially in cold weather **(p 62).**

DISTRIBUTION ▶ **Arcing is abolished by a manually closed circuit breaker** which uses a spring to snap contacts closed in the wink of an eye. The breaker latches closed, but will trip promptly if it closes on a fault **(p 71).**

HEATING & COOLING ▶ **Heat pumps went into an old, 10-story office building in Raleigh,** N. C,. after a boiler had to be replaced. An order for a new boiler already had been placed, but Carolina P&L convinced the building management that heat pumps offered a better way to heat and cool the building. Sixteen heat pumps were installed, plus 137 kw in strip heaters. This produced a new load of 206 kw **(p 76).**

PREVIEW OF THIS WEEK'S ELECTRICAL WORLD

INDUSTRIAL ▶ More utilities will be turning to Power-Up program for help in stimulating growth of industrial power to meet production requirements of the future in view of a growing labor shortage. Recent survey shows that all of 550 plants questioned have inadequate main transformer capacity to meet demands through 1965, and 94% have no automatic load ratio control or 277-v lighting. Power-Up now emphasizes electrical planning today to meet tomorrow's load. The one-year-old program offers a variety of aids to utilities seeking to strengthen their industrial customers (p 48).

FINANCE ▶ New utility security issues have gone "very well" since the Federal Reserve Board cut its rediscount rate to 3% . . . Utility common stocks listed on the N.Y. Stock Exchange are increasing in value at a fast clip . . . Pacing a lightning-fast population growth (222% in the last 26 years) California Electric Power Co will sink over $100 million into construction in the next five or six years, President Ernst reports (p 89).

Capital outlays for future transmission facilities may increase up to 20% more than those for other plant facilities, PEA hears (p 56) . . . In many cases, persons receiving artificial respiration get no air because head is positioned improperly (p 55).

PEOPLE ▶ Southern Electric Generating Co has appointed Andrew E. Burnett as operating manager . . . Interstate Power Co names its president and board chairman, M. L. Kapp, to the position of senior officer . . . Allis-Chalmers Mfg Co has elected to vice presidencies William M. Wallace, P. F. Bauer, and E. J. Mercer. A. D. Dennis is the company's new secretary . . . Eta Kappa Nu chooses Glenn W. Stagg, senior American G&E engineer, as one of the nation's three outstanding electrical engineers in 1957 (p 98).

MANUFACTURERS ▶ General purpose dry-type transformers, built in accordance with newly revised standards of NEMA's Specialty Transformer Section, will operate at considerably lower sound levels than units built to previous standards . . . Silver-plated aluminum bus conductors are made commercially feasible by a new manufacturing process. The buses can be joined with simple soldering and brazing techniques and require no special surface preparation for bolted connections . . . N. Y. State Power Authority accepts Allis-Chalmers Mfg Co's bid for 12 motor-generators for Tuscarora power plant of Niagara project (p 94).

NEW EQUIPMENT ▶ Overvoltage protector guards series capacitor banks during faults. Internally, it has gap and spiral electrodes to minimize burning . . . Light control calibrator checks street light controls for calibration and circuitry in two minutes for local adjustments (p 80).

ENGINEERING TRENDS

A wind-powered generator would need 1,000 sq ft of cross section to supply a 1-kw load in a 10-mph wind, which is about the average for northeastern U. S., according to Bell Laboratories experiments with wind-driven battery chargers.

Substantial savings in transmission cost are seen in tower footings designed to match soil and loading requirements. This becomes important as lines are built on marginal lands to escape rising rights-of-way costs. Precise design based on soil borings is credited with saving up to $4,000 per mile.

Transformer noise is cut effectively by supporting radiators independent of the tank, using flexible connections to prevent noise transfer, and by enclosing the tank in a non-resonant shell. Additional quieting is achieved by designing shell to avoid resonance at a noise frequency and by lining it with an acoustical insulation. Such treatment attains almost 20 db of quieting at a lower cost than any other method applicable today.

Power transformer failures from bubbles in the oil can be minimized by closer regulation of top-gas pressure. For inert-gas-blanketed units, this may require venting gas during prolonged load periods and replenishing it from the cylinder during subsequent cooling periods.

New medium-voltage lightning arresters are expected to cut power-follow while retaining the high discharge characteristics of present designs.

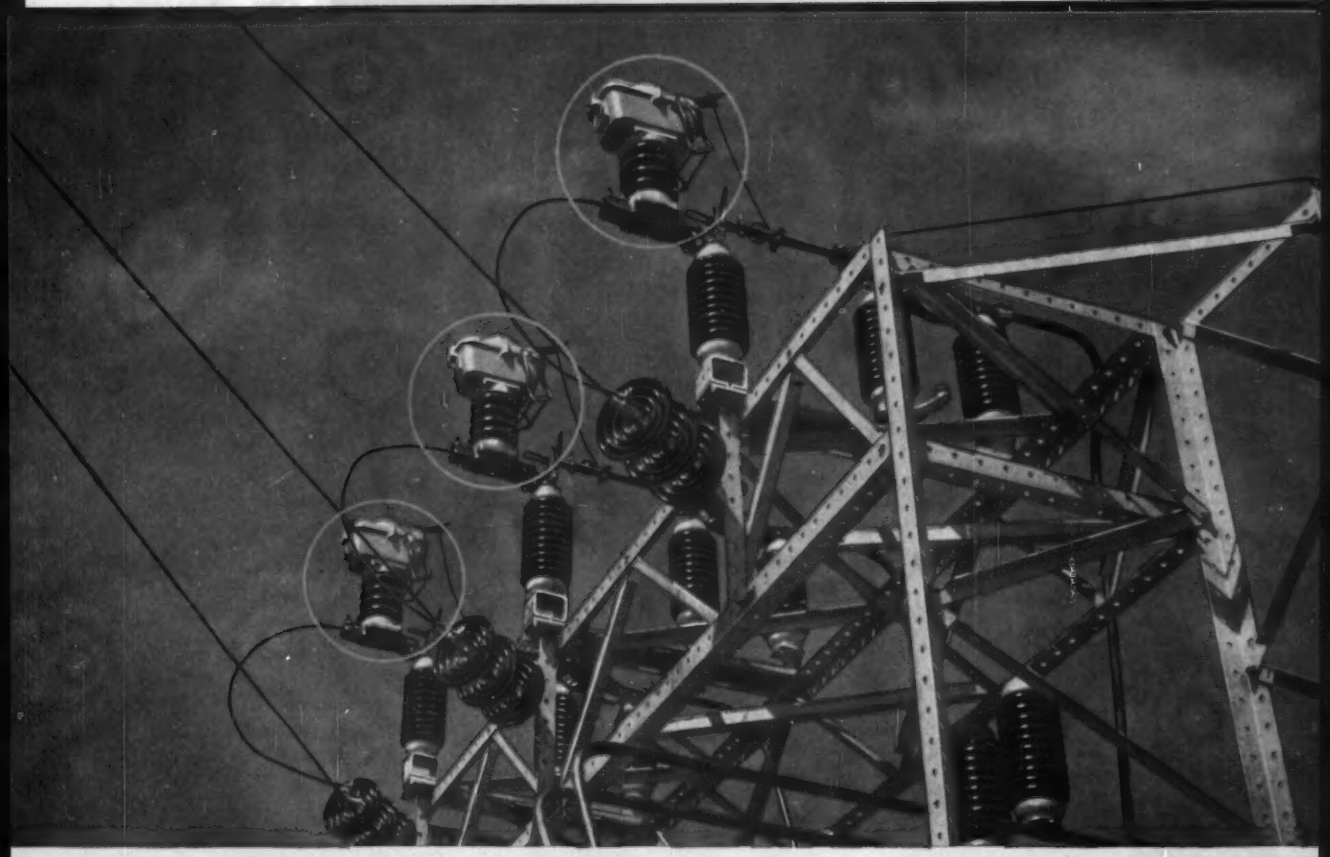
Cable duct temperatures can be computed correctly by the Kennelly formula if soil constants used in the formula are determined by actual field tests. Constants depend upon the type of soil, and seemingly cannot be determined accurately in the laboratory because test setups fail to duplicate the heat transfers of cable installations.

Heat transfer is improved by acoustic vibrations while desposition of boiler or chemical scale and precipitates on walls of tanks or in tubes is retarded by the same technique.

FROM EDITORS IN THE FIELD

Response of the nuclear heat source is not expected to limit the emergency performance of the Shippingport PWR plant.

Fly ash sales average over 1,000 tons per month for two Pennsylvania utilities. In addition, they have used 6,000 tons on their own systems as an extender for cement or asphalt or a choke in access road construction.



THE NEW L-M OIL INTERRUPTER provides high-speed circuit interruption on sub-transmission circuits without external arc or flame. The unit costs less than half as much as other interrupters for the same application.

New High-Voltage Oil Interrupter For Only $290 Per Pole for 69 kv

Units cost less than half as much as other interrupters for the same application—$240 per pole for 23 kv and 34 kv, $265 per pole for 46 kv, and $290 per pole for 69 kv.

Now you can get an economical, high-voltage oil interrupter for sectionalizing and switching on sub-transmission circuits. The unit is capable of interrupting load currents, line charging currents, and transformer magnetizing currents. It easily meets NEMA and AIEE standards, including the ice test.

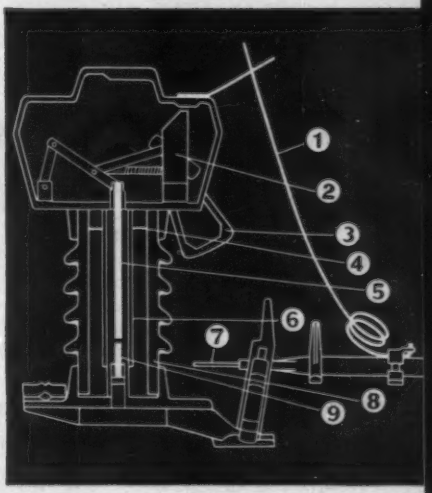
Contacts Separate At High Speed

The L-M interrupter consists of an oil-filled unit housed in a porcelain insulator, and a rod to shunt the current through the interrupter while the main switch blade is being disconnected. As the switch blade rises, it engages a spring trip lever which rises to over-toggle position, causing the contacts within the unit to separate under oil at high speed. The speed of the moving contact is independent of the operation of the main switch blade.

Contacts have long-life copper-tungsten arcing tips. All linkages are made of aluminum for lightness and fast operation. A simple fiber-washer arrangement provides a spiral passage for the pressure-generating arc, forcing oil and un-ionized gas around the arc core as the moving contact is withdrawn. This assures rapid arc extinction at low current values.

Ratings 23 kv Through 69 kv

L-M's new interrupter is available in 23, 34.5, 46 and 69 kv ratings. Continuous current rating is 600 amperes; momentary and short-time current ratings are 40,000 amps. for 10 cycles, and 25,000 amps. for 4 seconds. The unit can be installed on any of L-M's PV switches without altering the original parts. The addition of the interrupter does not change the electrical clearance or the phase spacing of the switch.



Cutaway View of Oil Interrupter

1. By-pass rod
2. Toggle mechanism
3. Trip lever
4. Oil level
5. Moving contact
6. Interrupter
7. Trip rod
8. Bushing
9. Stationary contact

Get Complete Information

Ask your L-M Field Engineer for more complete information on L-M's new high-voltage oil interrupter and on L-M's outstanding power switching equipment. Or write Line Material Industries, Milwaukee 1, Wis.

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LINE MATERIAL Industries

McGRAW-EDISON COMPANY

LM Power Switching Equipment

McGRAW EDISON

L-M's New 32-Step Regulator Combines All Desirable Features in One Unit... Plus:

- **reliable, accurate regulation**
- **smooth tap changes, long life**
- **ease of installation and maintenance**

by **N. K. DELANEY**
Product Manager,
Capacitors and
Regulators, Line
Material Industries

Line Material has designed into one compact, efficient regulator all the desirable features found in all other standard makes—plus a few L-M "exclusives."

Sensitive Voltage Control

L-M uses an induction disc-type contact-making voltmeter for reliable, accurate voltage control. The unit is very sensitive, and easily adjustable to a band width of from plus and minus ¾ to plus and minus 6 volts. An integrated time-delay device is used to control the tap-change operation. The time delay can be adjusted independently on both "raise" and "lower" through a range of from 10 to 120 seconds.

Maximum Contact Life

The tap-changing mechanism on L-M's new 32-step regulator is designed to assure smooth operation and maximum contact life. The speed of the tap changer is hydraulically controlled to assure minimum arcing. This, plus a reactor which bridges across adjacent taps during operation, permits smooth tap changes, without current interruption or voltage dip.

Easy to Inspect

The complete internal assembly of the regulator is suspended from the cover to simplify untanking for periodic inspection and maintenance. This desirable feature permits you to inspect all mechanical and electrical parts quickly and easily without draining oil or dismantling the unit.

Less Bending Moment On Pole

The L-M exclusive obround tank design makes the unit smaller, lighter, with shorter moment arm distance from the pole. The unit is easier to handle and install, and the design substantially decreases the total bending moment on the pole.

Greater Current Capacity With ADD-AMP Feature

It is possible to increase the load-carrying capacity of L-M's new regulator up to 160% of its normal rating by reducing the regulation to ±5%. The range of regulation can be reduced externally without de-energizing the regulator.

Get More Information

Ask your L-M Field Engineer for more information on L-M's new 32-step regulator—the regulator with all the best operating and convenience features available on any and all other pole-type regulators. Or write Line Material Industries, Milwaukee 1, Wisconsin.

301

Bushings are corona-free, and are designed for minimum radio interference.

Moving contacts and arcing tips of stationary contacts are made of arc-resistant copper-tungsten alloy to assure long contact life.

Bridging reactor provides smooth tap changes . . . no current interruption or voltage dip.

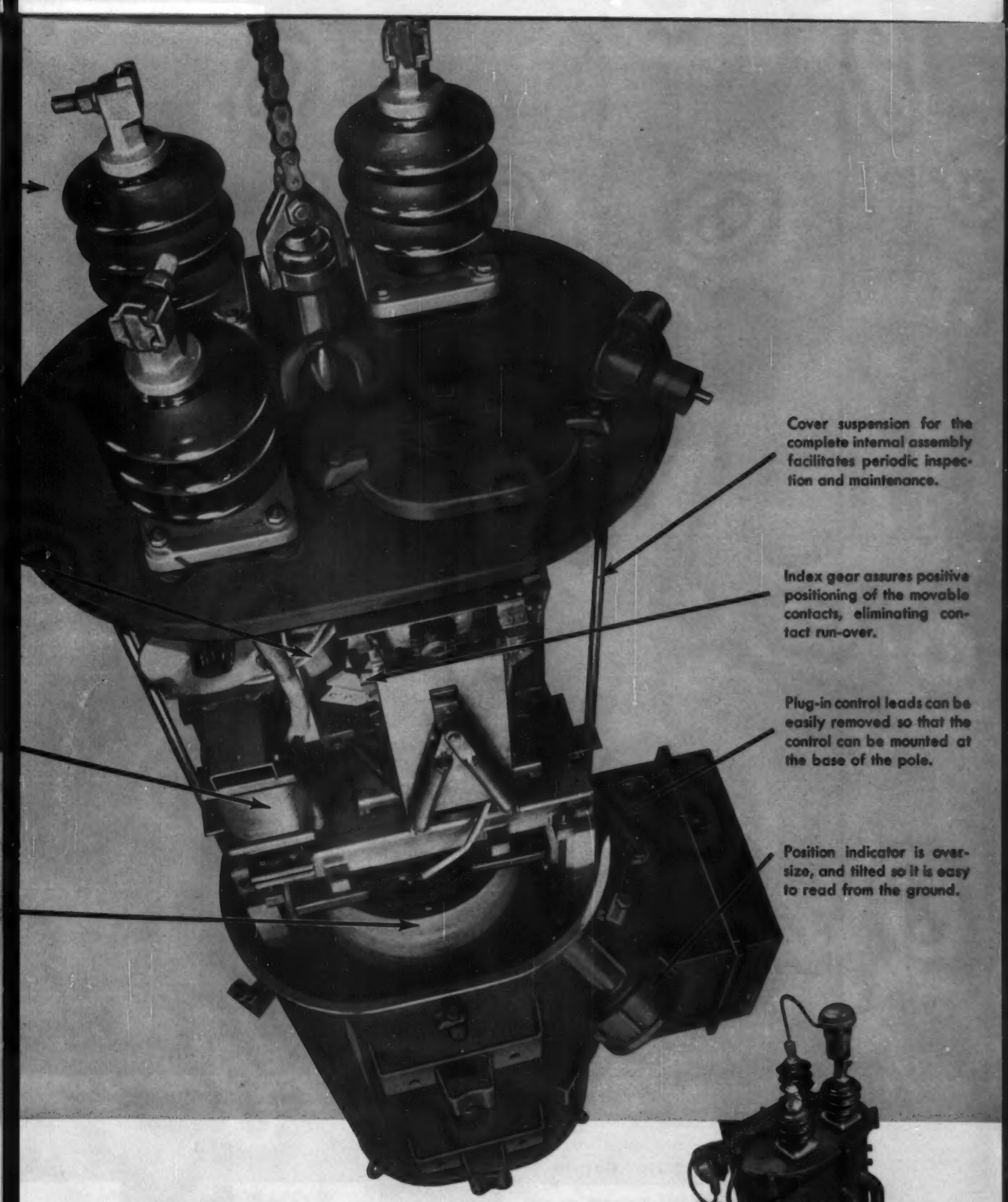
L-M's exclusive Round-Wound core-coil assembly provides a balance of low copper loss, low exciting current, and low core loss.

Available Ratings

2500 volts . . .
100, 150 and 200 amperes
5000 volts . . .
50, 100, 150 and 200 amperes
7620 volts . . .
25, 50, 75, 100, 150 amperes

LINE MATERIAL Industries

McGRAW-EDISON COMPANY



Cover suspension for the complete internal assembly facilitates periodic inspection and maintenance.

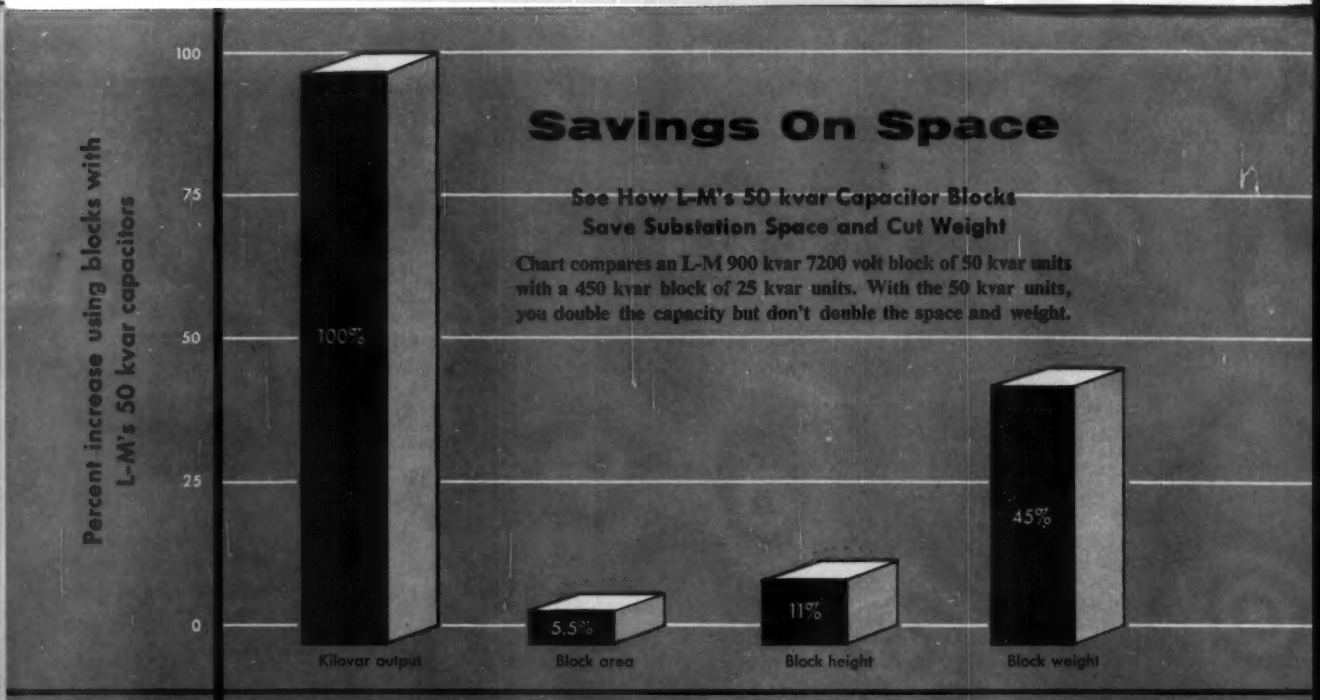
Index gear assures positive positioning of the movable contacts, eliminating contact run-over.

Plug-in control leads can be easily removed so that the control can be mounted at the base of the pole.

Position indicator is oversize, and tilted so it is easy to read from the ground.

Regulators

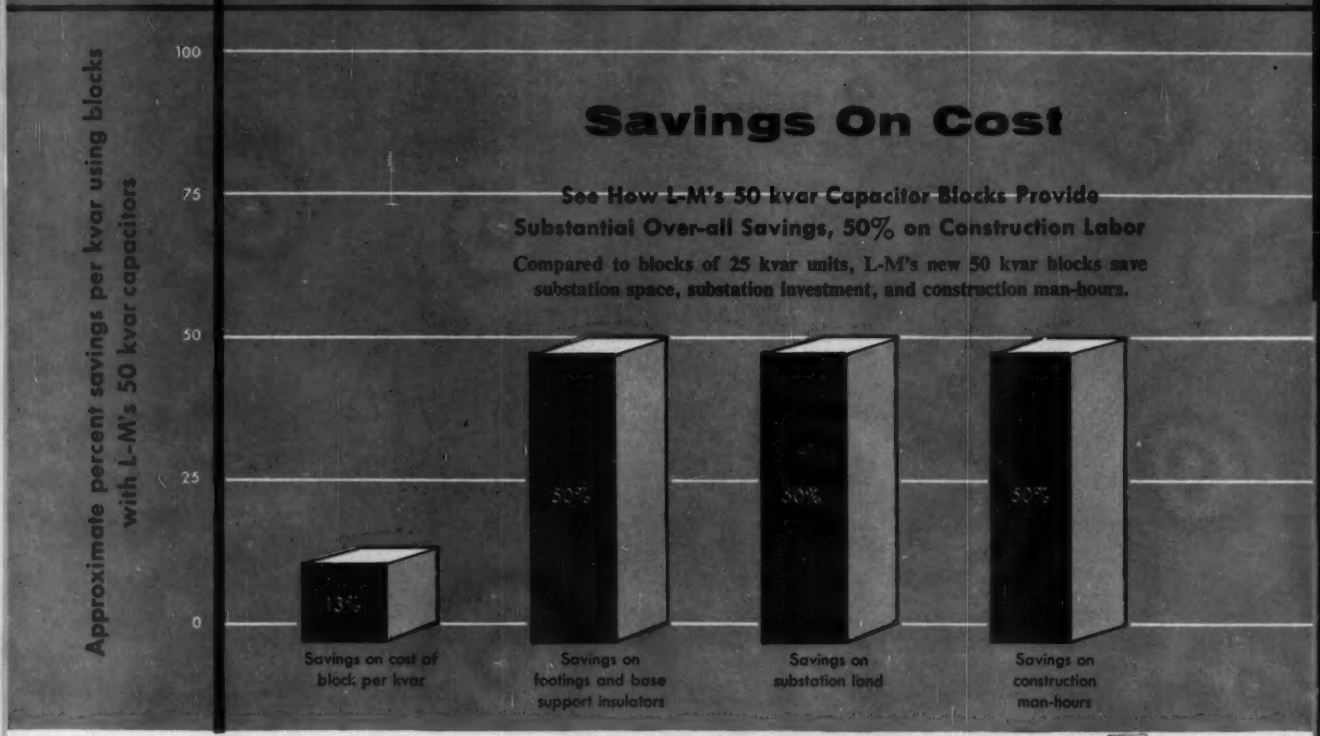
McGRAW EDISON



Savings On Space

See How L-M's 50 kvar Capacitor Blocks Save Substation Space and Cut Weight

Chart compares an L-M 900 kvar 7200 volt block of 50 kvar units with a 450 kvar block of 25 kvar units. With the 50 kvar units, you double the capacity but don't double the space and weight.



Savings On Cost

See How L-M's 50 kvar Capacitor Blocks Provide Substantial Over-all Savings, 50% on Construction Labor

Compared to blocks of 25 kvar units, L-M's new 50 kvar blocks save substation space, substation investment, and construction man-hours.

ANOTHER L-M CAPACITOR FIRST . . .

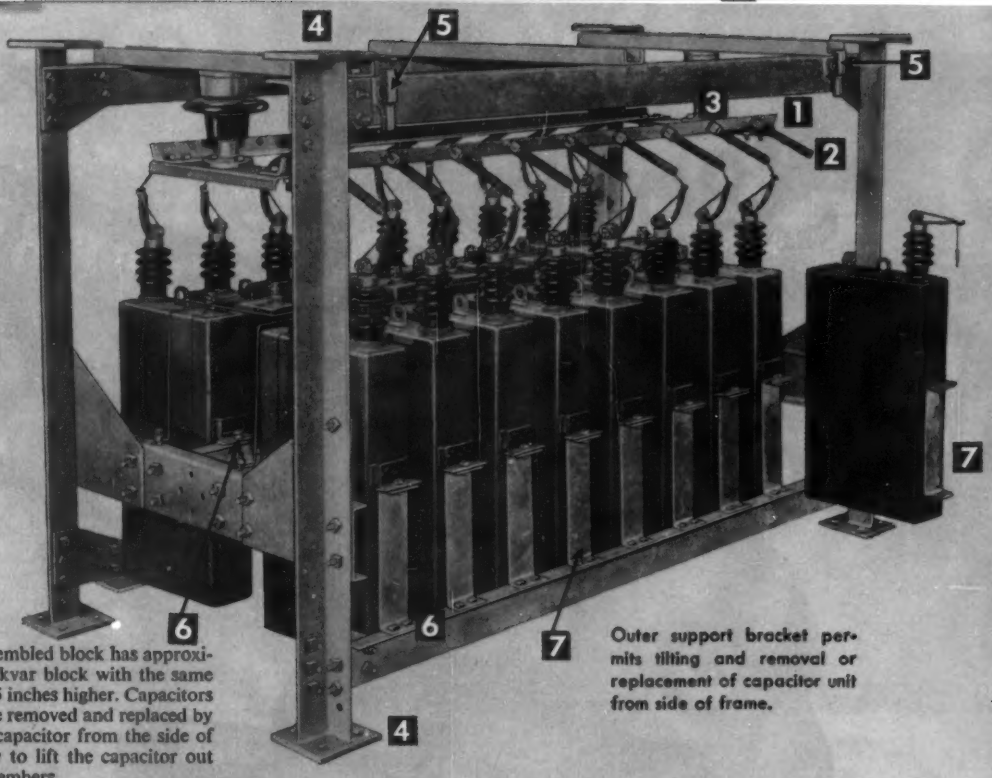
Units Now Shipped In New "Tear Strip" Carton

All individual L-M capacitor units are now packed in cartons that can be quickly and easily removed.

The new carton has a reinforced cloth tape cemented around the inside about two inches above the bottom. The tape is attached to pull tabs on the outside of the carton. When the tab is pulled, the tape makes a cut completely around the carton. The carton can then be quickly and easily lifted off the capacitor.

Simply pull the tape—to remove the carton.

296-R


1 Aluminum-alloy bus
2 Bus-mounted fuses
3 Bus connections wire brushed and treated with oxidation inhibitor.
4 Jig-assembled for perfect alignment of mounting pad bolt holes.
5 Lifting lugs.
6 Tapped holes in frame for capacitor mounting bolts. Nuts not needed.
7 Outer support bracket permits tilting and removal or replacement of capacitor unit from side of frame.

L-M's new 50 kvar factory-assembled block has approximately the same area as a 25 kvar block with the same number of units and it is only 5 inches higher. Capacitors in L-M's 50 kvar blocks can be removed and replaced by simply tilting and sliding the capacitor from the side of the block. It is not necessary to lift the capacitor out from between the mounting members.

Another L-M First...

L-M's 50 Kvar Capacitor Blocks Provide Kilovars At Still Lower Costs

By **BLAINE SCHULTZ**
Chief Engineer
Capacitors and Regulators
Line Material Industries

Only half as many units are required in substation capacitor banks when you use L-M's new blocks of 50 kvar capacitors. In addition, these blocks reduce the number of fuses, footings, and base support insulators, as well as the construction man-hours required for any given-size bank. L-M 50 kvar preassembled capacitor blocks also cost less and require about 50% of the substation area per kvar in comparison with blocks containing 25 kvar capacitors.

Capacitor Unit

The internal construction of L-M's 50 kvar capacitor is identical with that of the 25 kvar unit except for the length of pack. There is no increase in voltage stress to get the higher kvar rating. The new design is the result of continued improvement in dielectric materials and manufacturing techniques.

The tank has the same width, same thickness as the 25 kvar capacitor. Only 10 inches of additional height give you twice the capacity. It also has aluminum-metallized coating under alkyd resin paint; paragroove clamp-type terminals; strong solder-sealed bushings; and low-temperature Elemex liquid dielectric.

Factory-Assembled Blocks

L-M offers a complete line of NEMA Standard 50 kvar factory-assembled blocks from 2400 through 7960 volts—400 to 1200 kvar ratings in 100 kvar increments.

Outstanding features of L-M factory-assembled blocks include:

- Aluminum-alloy bus which is not subject to cold flow.
- Bus-mounted capacitor fuses with stainless-steel flipper to eject the leader if fuse link ever blows. Leader cannot hit live parts.
- Connections to the bus are wire brushed, and treated with oxidation inhibitor.
- Height of block is increased only 5 inches, because it is so designed that capacitors can be installed and removed from the *side*. It is not necessary to provide clearance to lift the capacitor out from between the mounting members.
- Heavy galvanized frame is jig-assembled for perfect alignment of mounting-pad bolt holes.

Prompt Delivery Now

You can save on the cost of equipment, man-hours, and space in the substation when you specify L-M NEMA standard 50 kvar capacitor equipments. Prompt delivery . . . on all sizes and voltage ratings. Ask your L-M Field Engineer for complete information on L-M's new 50 kvar factory-assembled capacitor equipments. Or write Line Material Industries, Milwaukee 1, Wisconsin.

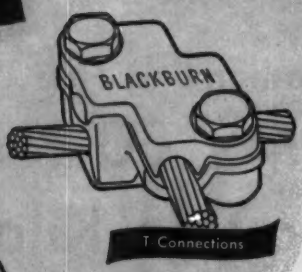
McGRAW EDISON

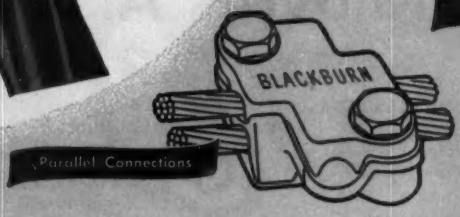
296-AR1

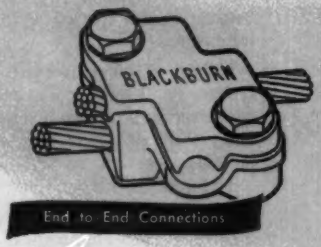
LINE MATERIAL Industries *Elemex Capacitors*
McGRAW-EDISON COMPANY

You can handle a wide variety of jobs with this

Stronger, More Versatile BLACKBURN Cross Tap CLAMP







Get quick service for a large number of different connection and wiring jobs with BLACKBURN'S Cross Tap Clamp.

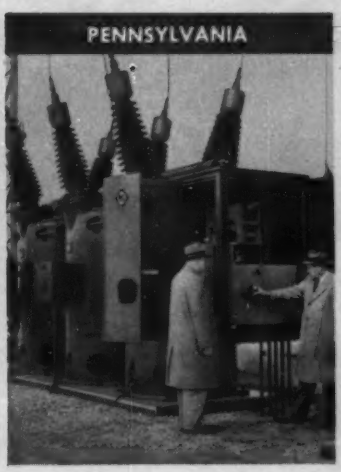
- **Eight connectors accommodate cable sizes from #6 to 1000 MCM.**
- **Made of high strength copper alloy; silicon bronze bolts; phosphor bronze shakeproof lockwashers.**
- **Rounded edges for easy taping.**
- **Greater wrench rotation with either end or socket type speeds installation.**
- **Available from Electrical Distributors everywhere.**

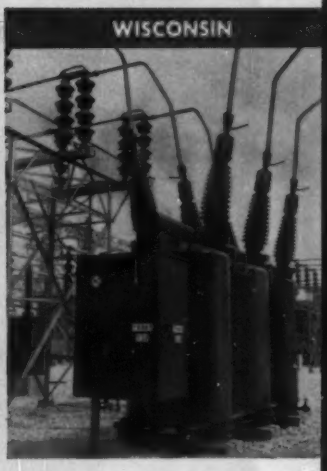
Also available completely tin plated for general purpose work.

JASPER BLACKBURN CORPORATION

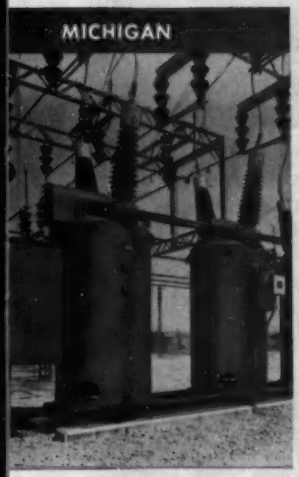
1525 Woodson Rd., St. Louis 14, Mo., WYdown 3-9430

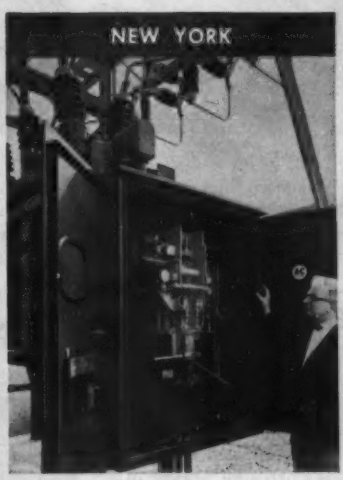
Utilities everywhere like Pneu-Draulic operators

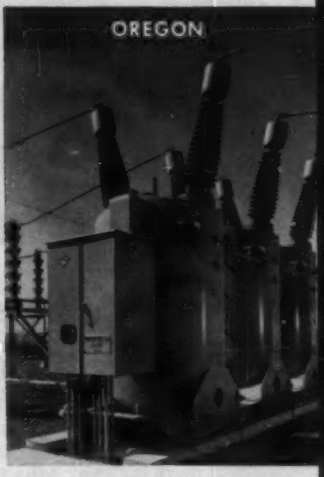




for their simplicity, reliability







***Pneu-Draulic* operators offer Utilities many advantages:**

- Simplicity — Compact design with few moving parts.
- Eliminates moisture, and corrosion problems — Entire system filled with oil containing inhibitor which eliminates rust, freezing and corrosion.
- Safe emergency closing — Breaker can be closed *safely* at full rated speed onto energized line even when no control power is available.
- Mechanically trip-free operation — Fully mechanically trip-free for complete system protection.
- Available on a wide range of breaker ratings — Breakers rated 500 mva and larger use the *Pneu-Draulic* operator as standard equipment.

Get details on these and other features of Allis-Chalmers breakers. Call your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

Pneu-Draulic is an Allis-Chalmers trademark.

A-5205

For cable ways along the highways...

Along today's modern highways easy-to-handle J-M Transite Ducts provide installation economies and years of service life, protecting traffic-signal, lighting, and other power-service circuits.

J-M Transite® Ducts install fast to last... give complete cable protection.

Because speed and economy set the pace in today's highway programs, more and more highway cables are going into Johns-Manville Transite Ducts.

For speed, Johns-Manville Transite Ducts are strong, light and long—easy to handle and install. Workmen set 10-foot lengths in place easily, join them up tight in seconds with snug-fitting J-M Plastic Couplings, and Transite's smooth bore is free of burrs and other obstructions that may interfere or cause damage during pulling of cables.

For economy, J-M asbestos-cement Transite Ducts go in to stay. Non-conductive Transite is not affected by electrolysis—resists the corrosive action of fills or high-salt soils in permanently damp locations. Millions of feet of installed Transite Ducts have proved that Transite withstands earth loads and soil stress... resists vibration and shock from highway traffic.

Let us send you free Transite Duct brochure EL-29A. Write Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit, Ontario.

JOHNS-MANVILLE JM PRODUCTS

Johns-Manville Asbestos Transite Ducts can be laid directly in trench without concrete envelope or other mechanical protection.

JOHNS-MANVILLE Transite Ducts

Made of Asbestos-Cement

J-M Conduit for direct buried banks and exposed runs
J-M Korduct® for concrete banks

NOW! A 2000-AMP, TWO-INSULATOR GROUP-OPERATED SWITCH

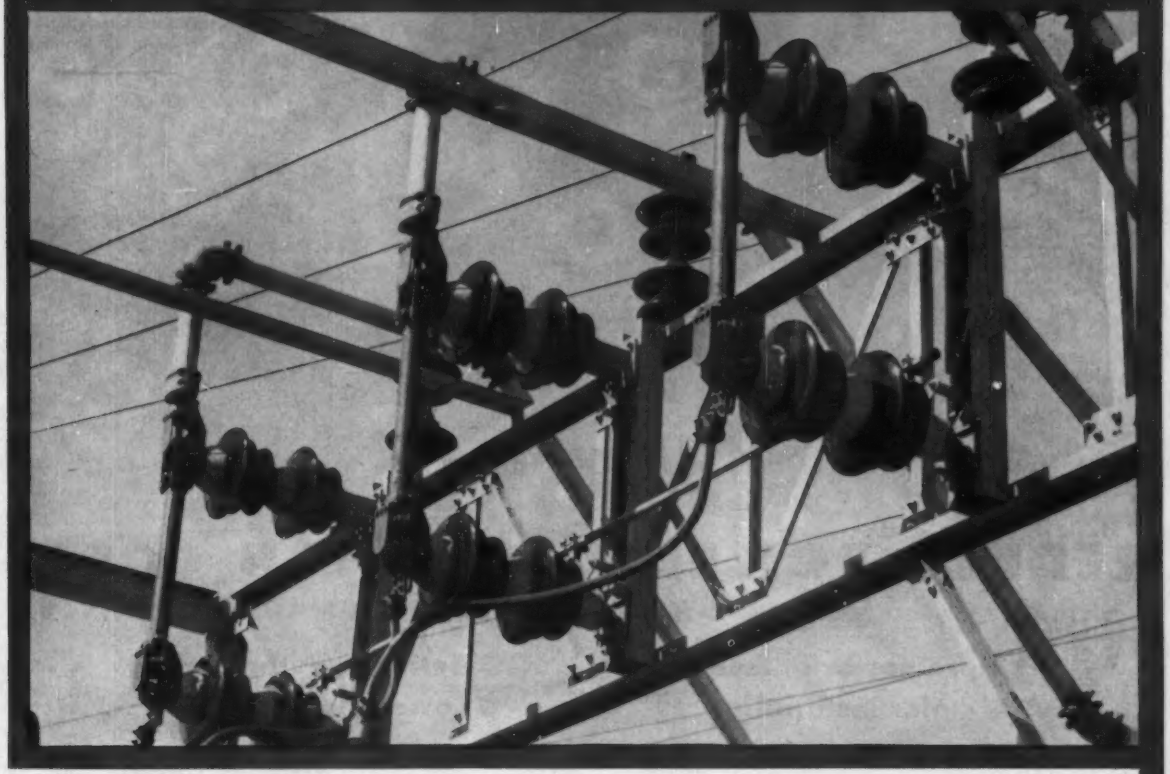


Photo courtesy Long Island Lighting Co.

another distinguished member of a distinguished line* . . . created for economy and designed at the request of utility engineers by one of industry's oldest and most reputable firms

**400 to 2000 amp: 7.5 to 115 kv*

MEMCO

Personalized service

MEMCO ENGINEERING & MANUFACTURING CO., INC.
COMMACK, L. I., N. Y.

This is the latest in precise, adjustable speed control for draft fans and BF pumps!

E-M standard construction for most indoor applications.

REDUCE BOILER OPERATION COSTS

with one of the four *new* E-M ADJUSTABLE SPEED MAGNETIC DRIVES

- **More power in less space**
- **Simpler installation**
- **Better, quieter cooling**
- **Lower maintenance**

E-M Magnetic Drives help you reduce costs of auxiliary drive power and maintenance. Here's how:

LOWER POWER COSTS by eliminating need for wasteful throttling of boiler feedwater pumps and draft fans. Magnetic Drives *control speed* for efficient operation of auxiliaries.

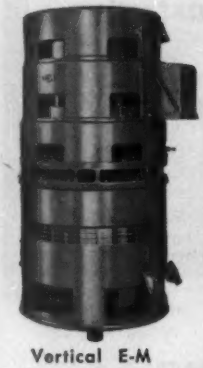
MINIMIZE FAN EROSION by operating fans at speeds to fit boiler combustion demands.

HAVE FAST RESPONSE to improve combustion and cut down thermal losses.

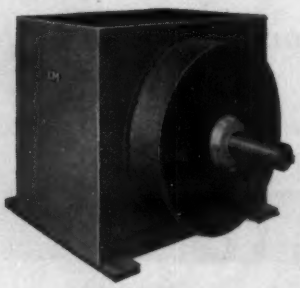
GIVE ACCURATE SPEED CONTROL. "Regutron" Control is responsive to *speed* of driven equipment regardless of changes in operating conditions. "Magnetic action" gives ±½% sensitivity. Anti-hunt and damping circuits assure stable operation.

OFFER BROAD SPEED RANGE. A large number of speed steps gives virtually stepless speed control . . . lets you select and keep exact speed.

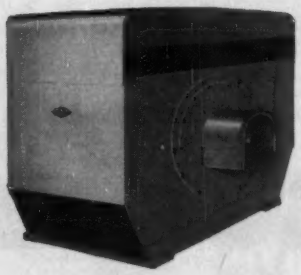
Write E-M for literature, or call your nearby E-M Field Engineer. He'll be glad to tell you first-hand all about the new developments in E-M Magnetic Drives.



Vertical E-M Magnetic Drive and Motor.



Top air discharge type for larger high speed ratings. Heat can be ducted away.



Weather-protected outdoor design. Screened intakes at feet, discharge near top.

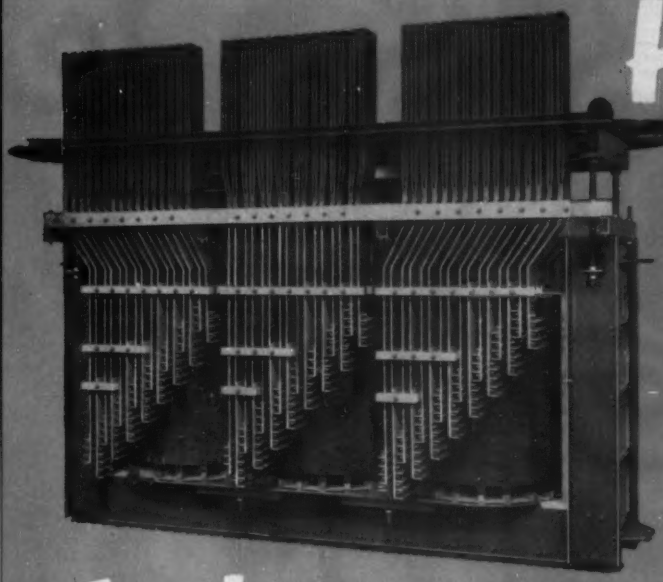
A606-TPA-2178

ELECTRIC MACHINERY MFG. COMPANY

Minneapolis 13, Minnesota

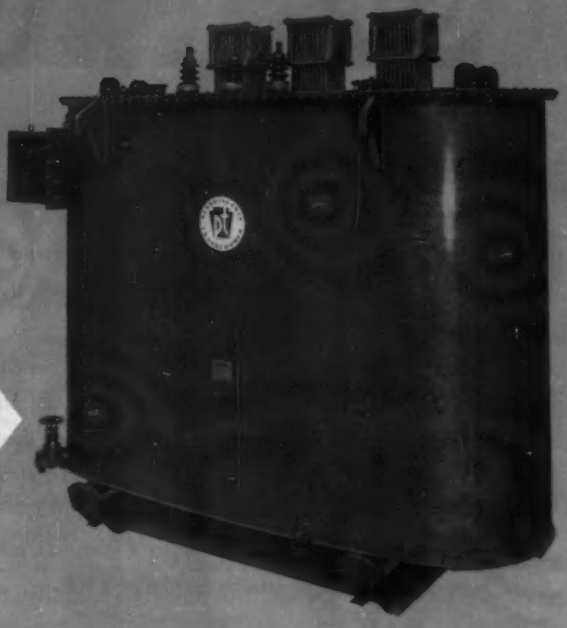
Specialists in making drives do **EXACTLY WHAT YOU WANT THEM TO**

what are your FURNACE TRANSFORMER requirements?



High Current?

The **32,000-ampere** low voltage line current for which this Pennsylvania Furnace Transformer is designed is one of the highest current ratings ever provided for a furnace transformer in this country. The transformer is rated at 16,000/21,300 kva. High voltage: 13,200△ volts. Low voltage: 250△ volts with a full-capacity tap range in 10-volt steps down to 150 volts.



Fast Delivery?

Only 20 calendar days were required to build and ship this 25,000-kva Pennsylvania Furnace Transformer. Even the *promised* shipping period of four weeks had looked like excellent service to the West Coast steelmaker—and by cutting this time by one-fourth, Pennsylvania saved the customer several days of costly downtime for the electric furnace involved. High voltage: 6,600 volts. Low voltage: 450 to 300 volts.

OF COURSE . . . it takes a lot of "everyday" know-how to accomplish the unusual with furnace transformers. Pennsylvania has established a nation-wide reputation for tackling and solving the most difficult problems in this highly demanding field . . . and not-so-incidentally, has designed and built virtually every size and type of furnace transformer now in use: from 250 through 25,000 kva, and from 3175 through 82,000 amperes. To put this furnace transformer experience to work for you, contact Pennsylvania Transformer Division, McGraw-Edison Company, Box 330, Canonsburg, Pa.

PENNSYLVANIA pt **FURNACE TRANSFORMERS**

McGRAW EDISON

Tough! Durable! Easy Stripping!

Southwire VWP*

* VINYL WEATHERPROOFING

For Line Wire and Service Drops

HERE'S the ultimate in a weather-resistant covering. Southwire VWP combines ruggedness with good weathering, aging and dielectrical properties. It permits a wire of smaller over-all diameter—a lighter wire that's tough, strong, easy to handle.

Ask any man who's put it up how easy it is to strip—how it speeds installation. Pull it over crossarms! Drag it over rocky ground! Southwire VWP is made to take it.

And best of all, Southwire VWP is priced to sell competitively.

Write for free bulletin which gives complete information and technical data on Southwire VWP.

Check these features

- It's tough—resists mechanical abuse.
- Light and easy to handle. Permits free stripping.
- Excellent weathering properties—resists sunlight and aging.
- High impact strength; high abrasion and tear resistance.
- High tensile strength and elongation. Good flexing properties.
- Excellent electrical properties.
- Has very wide installation-temperature range; even wider operating-temperature range.
- Resists flame; will not support combustion.
- Resists acids, alkalies and other chemicals. Resists oil and grease.
- Low moisture absorption.
- Unaffected by oxygen and ozone.
- Superior properties permit thinner jacket, smaller over-all wire diameter.

SOUTHWIRE serves the world

with these quality products:

- Bare and Weatherproof Copper and Aluminum Line Wire
- Neoprene, Polyethylene, and VWP* (Vinyl) Weatherproof Copper, Aluminum and Triplex
- U.R.C. (DBWP, TBWP) Copper
- Copperweld® Conductors
- Copper and Aluminum Building Wire
- ACSR and All Aluminum Cable
- Galvanized Steel Guy Strand and Static Wire
- Aluminized Steel Guy Strand and Static Wire
- Aluminum Alloy Wire
- Cable Accessories

Southwire® Company

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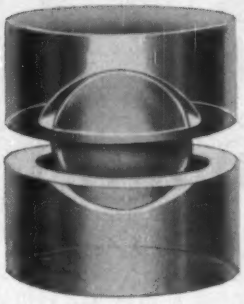
CARROLLTON, GEORGIA

Guaranteed for life!



All Sangamo Watthour Meters—singlephase and polyphase—have lifetime guarantee on materials, workmanship, and bearing system

The ball and jewel bearing system used for years in Sangamo Watthour Meters has been test-proven to withstand 800 million revolutions without appreciable wear. But Sangamo research has now determined that treating the cobenium ball bearing with Molykote® Microsize (the most highly purified molybdenum disulphide) will give such optimum performance that *the bearing system will never need relubrication, inspection or replacement!*

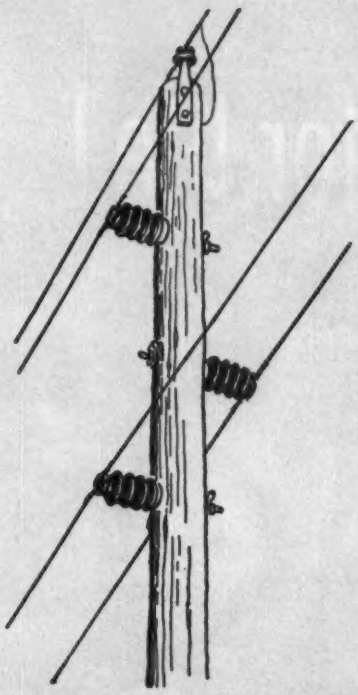
That's why Sangamo now offers an unprecedented lifetime guarantee —covering materials, workmanship, and bearing systems on all Sangamo Meters using the cobenium ball and sapphire jewel bearing system, made after October 1, 1957.

P.S. Ask your Sangamo Representative how you can use this discovery to add to the useful life of your existing meter bearing systems.

JM57-8

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS



A TROUBLE-FREE DISTRIBUTION LINE AT LOWEST COST

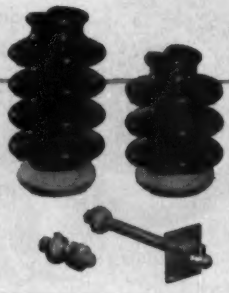
You can eliminate the cost of cross-arms, braces, brackets and other hardware—and probably build the best-performing distribution line on your system—by using new Lapp Distribution Post insulators. You just mount 'em horizontally, bolted directly to the pole.

This practice has the precedent of companies that have built such lines with regular Lapp Line Posts —and report them as "completely trouble-free."

The two Distribution Post units, for duty at voltages up to 25 Kv, both develop 1500 lbs. cantilever strength at insulator top. Constructed as a solid one-piece porcelain, they are completely crack-proof and puncture-proof. With Lapp Fog-Type corrugations, they present an exposed uniform leakage path—most efficient for use in contaminated atmosphere. Radio-free by design, and greatly more rugged than any other type of distribution insulator against flashover, stones and bullets. Separable stud bolts provide for their use with studs of any length.

For application in dirt condition areas, horizontal mounting adds the extra advantage of *better* cleaning in wind and rain.

Write for complete description and specifications. Lapp Insulator Co., Inc., Le Roy, N. Y.



LAPP DISTRIBUTION POSTS

Lapp

NEW ALUMINUM SUBSTATION STRUCTURE BOOKLET

SHOWS HOW TO CUT COSTS, REDUCE MAINTENANCE AND IMPROVE APPEARANCE WITH ALUMINUM

How does the cost of aluminum compare with that of steel in corrosive marine and industrial atmospheres? Do you think aluminum costs more? Actually, it costs *less*... and this new, free 48-page illustrated booklet will show you why.

"Aluminum Substation Structures" shows you many new and interesting facts about the use of aluminum in substations... facts that can pay off in big savings for you.

It lists the many ways in which aluminum can meet your substation specifications more efficiently and at less cost. It gives you up-to-date cost comparison data. It offers complete design information including numerous fact-filled tables and schematic drawings.

Here are examples of the type of information you will find in this handy new booklet:

ADVANTAGES OF ALUMINUM. Shows advantages such as reduced maintenance, lower erection costs, greater safety, reduced weight, improved appearance, etc.

MAINTENANCE COSTS. Comparative corrosion resistance of steel and aluminum used in marine and industrial atmospheres. Explains how aluminum saves you hundreds of dollars in maintenance costs.

COST ANALYSIS. Complete data, including quick reference graphs, showing cost comparisons of aluminum and steel for substation structures. This material was recently gathered from utilities, fabricators and electrical equipment manufacturers throughout the country.

DESIGNING ALUMINUM SUBSTATIONS. 28 pages full of design information, including safety factors, fastener clearance, deflection, ice and wind loadings and line loads.

RECOMMENDED ALLOYS. Tells you what alloys to use for substation structurals and fasteners. Gives a complete chemical composition of the most suitable alloys.

DESIGN TABLES. Easy-to-read tables with design data on such subjects as lattice type columns, chord members, maximum compressive stress and force in chord angles, lacing load with bolt shear as criteria, and many more.

You're sure to find helpful information in every section of this new booklet. To get your free copy of Kaiser Aluminum's *"Aluminum Substation Structures"* simply mail the coupon now.

MAIL THIS COUPON NOW!

KAISER ALUMINUM & CHEMICAL SALES, INC.
INDUSTRY DEVELOPMENT DEPARTMENT
919 N. Michigan Avenue
Chicago 11, Illinois

Gentlemen:
Please send me my free copy of *"Aluminum Substation Structures"* immediately.

NAME_____

TITLE_____

CITY_____ STATE_____

While Kaiser Aluminum does not fabricate and erect substation structures, we do supply leading erector-fabricators with high quality American standard extruded angles, channels and "I" beams. Call your local Kaiser Aluminum sales office for immediate attention.

KAISER ALUMINUM

THE BRIGHT STAR OF METALS

Enlarged drawing of Thermalastic insulation tape. High coil voltage can't get through the fish scale barrier of large mica splittings. The patented *elastic* impregnant expands and contracts with the coil to prevent tape separation; that's the *big difference* between Thermalastic insulation and other types.

Here's why Thermalastic insulation ends major cause of generator and motor failure

LARGE mica splittings have long been recognized as the most reliable coil insulation material, but for years it seemed impossible to find the RIGHT impregnant for the insulation tape.

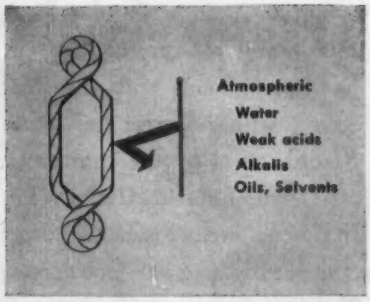
Some were too brittle and others too plastic at high coil temperatures; none could withstand repeated expansion and contraction of the coil . . . and sooner or later, tape separation caused failures.

Then the great discovery — In 1949, Westinghouse research scientists made *Thermalastic*® insulation a reality by discovering the "miracle resins" which cure to a *tough* resilient solid. Large mica splittings, overlapped like fish scales, are locked in this elastic bond which "breathes" . . . expands and contracts with the coil. It doesn't harden or soften with repeated heating by the coil. It doesn't deteriorate with age.

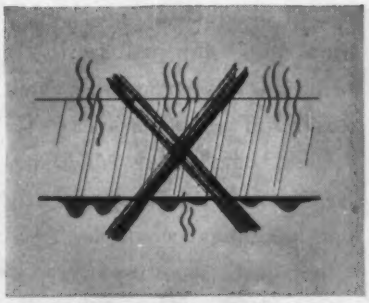
New color movie and bulletin show how and why Thermalastic insulation has extended the life of more than 40 million kva of generators and large motors. Contact your Westinghouse representative or write to Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pennsylvania. J-15004

YOU CAN BE SURE...IF IT'S

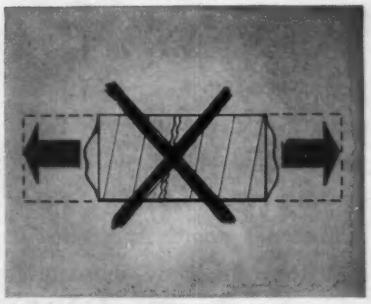
Westinghouse



Withstands attacks
which weaken and finally destroy other insulations. The Thermalastic insulation bond is void-free, has great density, and it's chemically inert. The physical strength of the resilient insulation wall is far greater than that of ordinary insulations.



Doesn't soften or embrittle
The patented resins in Thermalastic insulation are thermosetting . . . heat changes them from a liquid to a permanently elastic solid which doesn't soften or embrittle after repeated heating. And it doesn't deteriorate while in storage or in use.



Not stressed
The insulated coil is heated to operating temperature, and *while it's expanded*, the resins cure to an ELASTIC solid. That's why Thermalastic insulation is relaxed when the coil expands, compressed when it contracts. It flexes when the coil is overloaded.

now... you can sequentially record station operations automatically

at less than one-third the cost

Now... the new F&P Millisecond Operations Recorder — MOR — brings the benefits of automatic sequential recording within every station's reach. Less than one-third the cost of previous methods, MOR pays its way in small remote substations as well as large generating stations.

Recording every change in trouble contact position on a permanent logsheet, MOR establishes the exact sequence and time of events . . . *even when they're only milliseconds apart.* And since it operates completely automatically, you can depend on MOR for a complete, continuous log, even under upset conditions.

The system consists of a completely separate 400-point capacity recording device, and cabinet. Systems with fewer than 400 points are easily expanded to ultimate size by inserting a single printed circuit card for each additional ten points. All cards are interchangeable and readily available from Fischer & Porter stock.

Everything about MOR has been planned to keep reliability high, maintenance simple. Transistors and diodes are used throughout, eliminating the vast majority of moving parts, switches, and relays. About the only upkeep required is changing log sheets every few months . . . replacing the printing carbon once a year.

Complete information on MOR . . . how it operates . . . what it can contribute to your station operation . . . is in Catalog 30 A 1400, available on request. Or, just get in touch with the F&P Sales Engineer nearest you. Write Fischer & Porter Company, 5627 County Line Rd., Hatboro, Pa. In Canada, write Fischer & Porter (Canada) Ltd., 2700 Jane Street, Toronto, Ontario.

FISCHER & PORTER CO.

Complete Process Instrumentation

SPANTAP

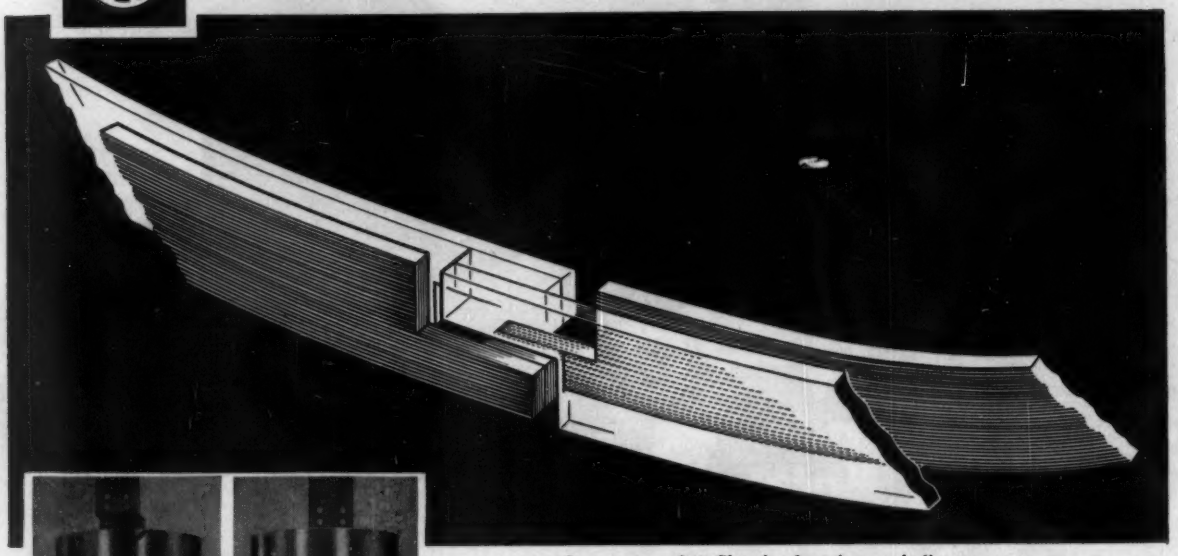
first fully engineered MID-SPAN TAP for cabled secondaries

- The phase SPANTAP, above, is installed on the run by tightening a single bolt! The insulating cover halves snap together...securely held by humpback cotter pins. Knockouts in the insulating cover permit insertion of taps without removing this cover!
- Up to 4 individual taps can be taken from one SPANTAP! Each service can be added or removed from the installed and fully-insulated SPANTAP... at any time!
- The stripping length for each tap is indicated on the face of the cover! The connection is made secure by tightening pressure bar assembly from the bottom of the SPANTAP.
- One neutral SPANTAP, below, deadends and connects up to 4 service drop neutrals to the neutral of the secondary — without disassembly of the connector.
- The service drop neutral is wrapped around the SPANTAP V-groove which produces a wedge-locked grip on the conductor. As stresses increase, the simple connection grows tighter!
- No further gripping action is required but the neutral SPANTAP has an anchor screw to secure each connection against severe winds and storms!
- Write for complete technical specifications. Burndy, Norwalk, Connect., Scarboro, Canada.

BURNDY

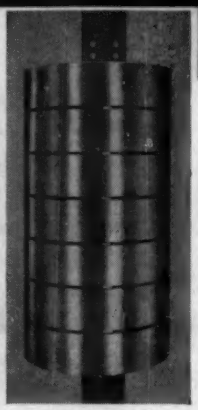
57-16

UNIT SUBSTATION TRANSFORMERS



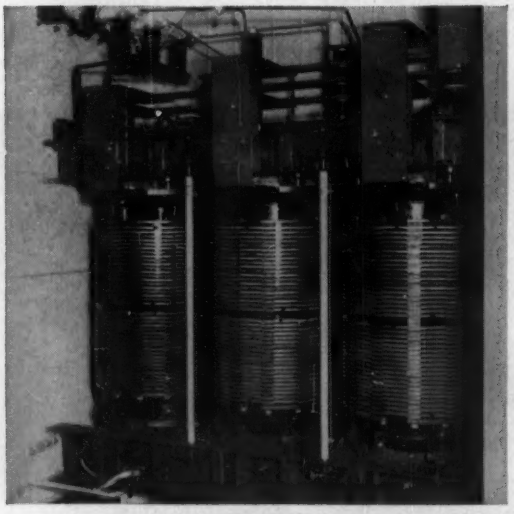
Crossover point. Showing how inner winding connects with outer winding at center of transformer secondary.

Diagonal connections between rings.



Crossover point on reverse side of transformer.

BRUTE STRENGTH SECONDARIES WOUND FROM SOLID BUS— NO MECHANICAL JOINTS



Completed dry-type transformer mounted in ventilated housing.

From one end of the secondary to the other in these I-T-E unit substation transformers, electricity flows through solid copper bus bar.

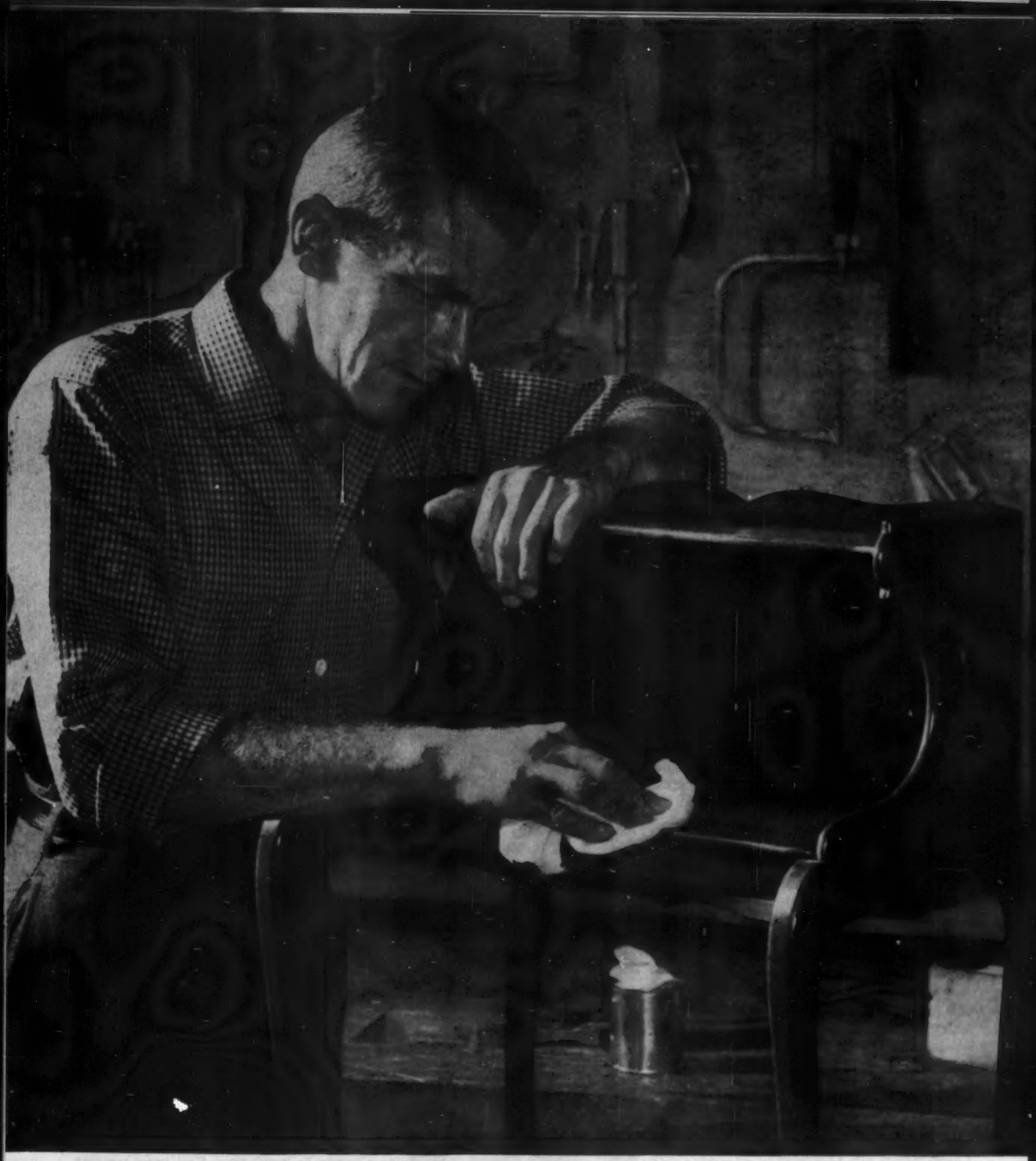
This is a unique design for high current secondary windings embodying great structural strength, plus low reactance and high conductivity. Lengths of copper bus, cut on a diagonal and formed into rings, are brazed together below the diagonal gap in such a manner as to form a continuous electrical winding.

Where greater current carrying capacity is required, two such windings are paralleled, but a crossover at the midpoint causes each of the parallel paths to have half its turns in the outer layer and half in the inner—equalizing the impedance of the two parallel paths and distributing the reactance evenly.

Write for complete information. I-T-E Circuit Breaker Company, Transformer & Rectifier Division, 19th & Hamilton Streets, Philadelphia 30, Pa.

I-T-E CIRCUIT BREAKER COMPANY

Transformer & Rectifier Division



TIME IS THE MEASURE OF ALL WOOD PRESERVATION

On the job–as on your own time–you know the importance of wood preservation.... The more the statistics accumulate, the more clearly the answer is AMCRECO pressure treatment.

AMCRECO
PRESSURE TREATED WOOD PRODUCTS

AMERICAN CREOSOTING CORPORATION LOUISVILLE 2, KENTUCKY
SUBSIDIARY OF UNION BAG-CAMP PAPER CORPORATION

HOW Westinghouse

JOB-TAILORED FLUORESCENT LAMPS MEET YOUR LIGHTING NEEDS

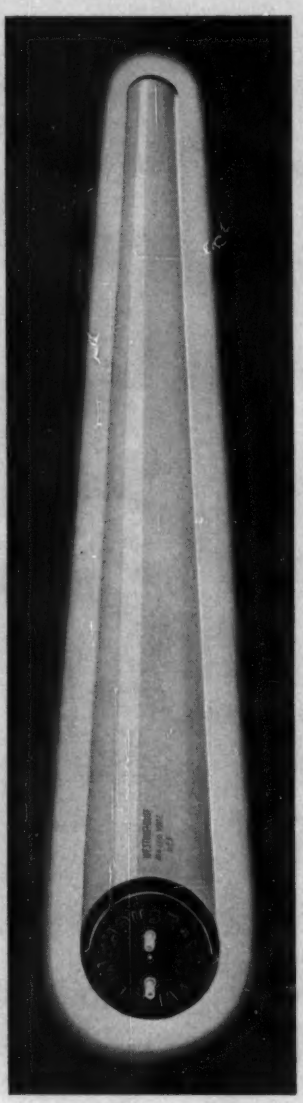
...all with ULTRALUME™ High-Intensity Phosphors • MORE LUMENS PER WATT... more light for your dollar • UNIFORM END-TO END LIGHT • PERFECT COLOR MATCH...ALWAYS • MAXIMUM OUTPUT MAINTAINED THROUGHOUT LONG LIFE

1. New SUPER-HI Fluorescent lamps produce more than twice the light per foot. Designed primarily for high bay (20 feet or higher) industrial and outdoor lighting, a new line of extra high light output fluorescent lamps produce more than twice as much light output per foot as standard fluorescent lamps. The new SUPER-HI lamps permit extremely high energy loading of electrodes, the arc stream and the phosphor. This gives you high light output with new economy at good efficiency and long life.

SUPER-HI lamps are light in weight, convenient to handle and provide a light source subject to the same easy optical control as with present standard T12 lamps, but with over twice the light output. Available in 105, 155, and 205 watts, 4, 6 and 8 ft. The lamps have a rated average useful life of 5000 hours, deliver 6000 to 13,000 initial lumens.

2. High Output Rapid Start lamps give more than 50% more light than regular type. Designed primarily for medium-high bay (15 to 20 feet) industrial and outdoor lighting, four new sizes of Westinghouse high output, rapid start fluorescent lamps can produce over 50% more light than comparable sizes of regular lamps and offer new economy and effectiveness to fluorescent lighting. These lamps provide increased lighting levels, make installations with adequate footcandle values of deluxe color light more practical, and improve the economy and practicability of fluorescent lighting at higher mountings and at lower ambient temperatures.

These lamps are available in 24", 48", 72" and 96" T12 design for general indoor use and for outdoor service where retention of light output at low temperatures is essential. The 72" T12 is recommended for street lighting.



3. Reflector-Fluorescent lamps produce 60% more directed light. For use where external reflectors are difficult or impractical to use, or where dirt deposit cuts lighting effectiveness, these Westinghouse Reflector-Fluorescent lamps provide a directional light distribution which helps put the light where you want it. This is accomplished by a built-in reflecting surface, extending the length of the lamp on the inside of the tube, which redirects about 60% extra light out the other side. Westinghouse Reflector-Fluorescent lamps are recommended for use in coves, showcases and other locations where space is limited. Indirect lighting effects may also be obtained by aiming the lamps toward the ceiling.

They also solve special lighting problems including temporary lighting for construction projects, displays, and exhibits.

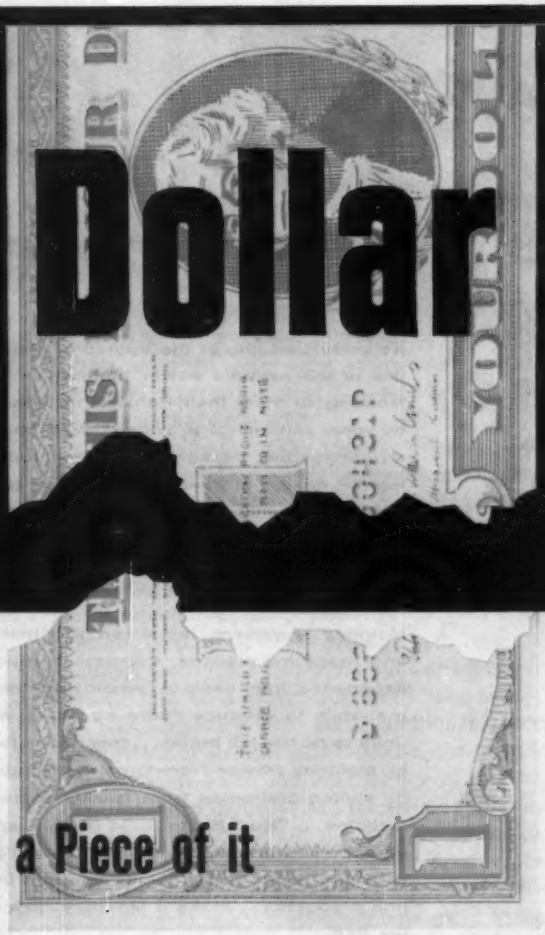
Westinghouse Reflector-Fluorescent lamps are available in 40 watt rapid start, 48" and 96" T12 slimline types.

4. Beauty Tone™ Home-line Fluorescent lamps with warm white deluxe color. The same new Westinghouse "Beauty Tone Home-line" lamps which are revolutionizing home lighting by providing warm white deluxe illumination are also ideal for offices, stores and wherever "friendly" color of light is wanted to flatter complexion, enhance the natural color of furnishings, decorations, and displays, and blend well with incandescent lighting.

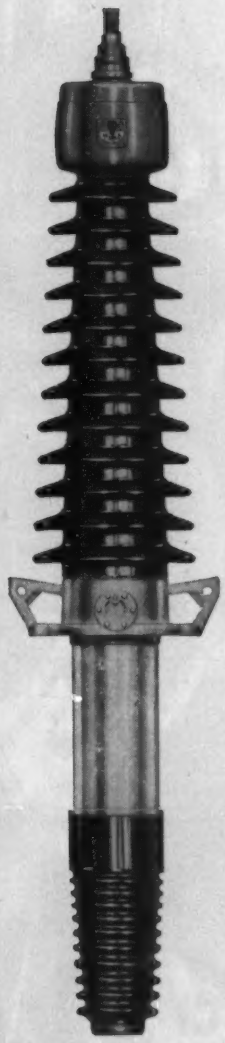
There's a network of Westinghouse distributors ready to serve you. Call your nearest Westinghouse Supplier for a free Job-Tailored Survey of your lighting requirements. Or write Westinghouse Lamp Division, Bloomfield, N. J.

YOU CAN BE SURE...IF IT'S Westinghouse

It's Your Dollar



Bushing Standards Will Save a Piece of it



Here are a few quick facts concerning bushing standards.

ASA Standard bushings will interchange on all new equipment, regardless of who made either the equipment or the bushings. Furthermore, standard bushings can be used on older, pre-standard equipment, because they have reduced diameters that permit adaptation.

Only one or two spare standard bushings, at any given voltage, will protect almost any amount of station apparatus.

Inventory investment in stand-by bushings, once a major capital item with most power companies, can eventually become almost negligible. This goes hand-in-hand with improved service protection.

Standards need your support—support best given by specifying ASA Standard bushings on all your new apparatus.

Remember, it's *your* dollar. Bushing standards will save a piece of it!

GOING BEYOND STANDARDS

Standards specify critical dimensions and basic electrical characteristics, wholly in the interest of interchangeability.

They *do not specify* knowledge of the bushing business, background of reputation, skillful design, or dependability—in other words, *they are not intended to specify* what constitutes a good investment of your company's dollar.

O-B condenser bushings offer the most up-to-date design available on the American market, produced with entirely new manufacturing facilities, and embodying exceptional electrical and structural refinements. While a new model, this bushing also retains the priceless ingredient of nearly 50 years' highly successful experience in the manufacture of bushings.

For complete adherence to ASA Standards, plus assurance of utmost dependability, ask for O-B bushing equipment on your new transformers and circuit breakers.

Ohio Brass

OHIO BRASS COMPANY • MANSFIELD, OHIO

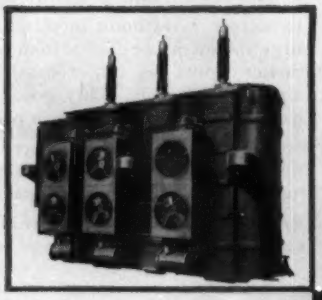
4796-H

MADE TO MEASURE

An understanding of the operating characteristics of the nation's power companies enables Moloney to meet their transformer needs. Over 60 years experience provides the company with an outstanding background for skillfully tailoring the design of power transformers to satisfy the requirements of individual systems. Moloney Power Transformers are made to the measure of your needs and to the measure of the unsurpassed Moloney reputation.

Moloney engineers, renowned for their ability and many innovations, translate compounded experience into designs employing the latest materials to produce more compact, efficient units to do the job better . . . stay on the job longer. Moloney Power Transformers are fabricated by skilled craftsmen from quality materials in facilities . . . "Built Big to Build Big" . . . specially equipped for the production of these big units. Give your system the quality inherent in these fine products . . . make it Moloney . . . all along the line.

MEET-22



Moloney Load Tap Changing Transformer. Rated 100,000 KVA, 3 phase, 60 cycle, Class FOA. High Voltage 161,000 Gr. Y_I Low Voltage 14,400 Delta. Load tap changing equipment provides a regulation of plus and minus 5% in 8—1¼% steps at the high voltage terminals.

MOLONEY ELECTRIC COMPANY

Manufacturers of Transformers for Utilities, Industry and Electronic Applications

Sales Offices in All Principal Cities
Factories at St. Louis 20, Mo., and Toronto, Ont., Canada

EDITORIALS

Needed: More Atomic Leadership by Utilities

There will certainly be a change in congressional attitude on the peace-time atom in the next session of Congress. Federal power advocates will of course again press for government construction of large nuclear power plants. And since the last session of Congress the turn of events have been such as to make their policy more appealing.

For one thing the atomic industry's market is too small for the many sellers of atomic ware. Many manufacturing companies are cutting back or dropping out of the nuclear business. What is probably even more important to the power industry is that present day cost estimates of current nuclear power projects are far greater than original estimates, making the economic use of nuclear fuel even more distant.

Nothing can be more sobering than an increase from $55 million to $90 million in the cost estimate of Consolidated Edison's Indian Point nuclear power plant.

Major nuclear power plants now being designed or constructed will cost about $430 per kw according to a report presented at the recent meeting of the Atomic Industrial Forum. The same report contained a prediction of a maximum of 6,000 Mw of nuclear capacity by 1968—a figure that is 40% less than most of the estimates issued only a year ago.

This market situation and high cost of equipment are problems of the first magnitude. One further problem is always with us—that is the pressure to assume world leadership in nuclear power for political rather than economic reasons. The solution to these problems seems clear to many—have the government take on more of the responsibility for the development of the atom.

Accordingly the utility industry must again review its part in nuclear power development against this background and formulate a positive program before, and not after, the government announces its plans. Circumstances beyond its control have till now made the utility industry a follower rather than a formulator of nuclear power development policy. But now that the complete scope of the problem is defined and the utility industry has had some nuclear experience, it should take on a greater share of leadership.

This suggestion may seem questionable because of the lack of an economic incentive, the tremendous development costs, the insufficiency of risk capital to a regulated industry, and the responsibility due to stockholders. These are all vital factors that dictate a moderate pace for nuclear power development by utilities. But despite all this logic, despite all the risk, the utility industry must contribute more in money and leadership.

Whatever the utility industry's approach, it should be positive and be formulated before the federal power advocates present their congressional recommendations. And it must not allow complete domination of nuclear power development by the government.

Power-Up America, There's a Job To Do!

. . . And it's a big job too! We estimate that by 1965 industry in the United States is going to need 585 billion kilowatt hours of energy annually.

In the face of this growth, the American industrial machine is seriously underpowered according to a survey recently reported by A. C. Monteith of Westinghouse. The survey covered 550 major manufacturing plants—plants big enough to have an engineering staff devoted to electrical matters. This is what the survey found:

- 100% of the plants had inadequate main transformer capacity to handle power loads based on 10-year growth.
- 52% had low incoming voltage.
- 85% had inadequate main breaker capacity.
- 94% had no automatic load ratio control.
- 89% had no main substation bus protection.
- 94% had no 277-volt lighting.

These electrical systems in industry cannot power a 55% increase in industrial consumption in the next eight years. The electrical engineers in this field have a big job ahead to "Power-up" for 1965.

POWER-UP!

Your Chance for an Industrial

Utilities hop on "Power-Up" bandwagon as 1958 campaign swings into action. Their aim is to create a large industrial load by helping manufacturing industry "electromate" to future needs

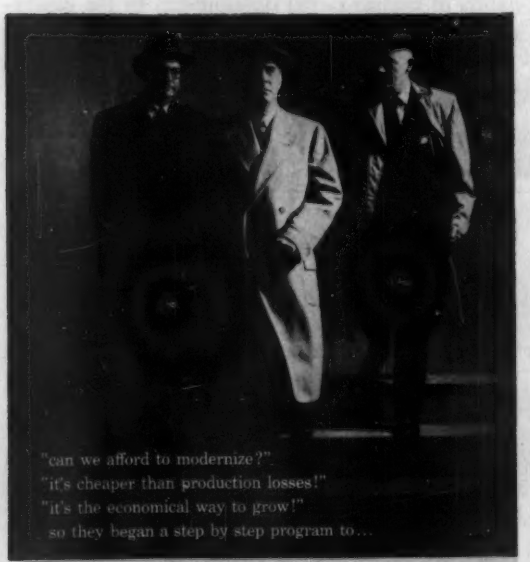
Electric utilities, as they firm up their sales plans for 1958, are taking a long hard look at a new type of partnership program—Power-Up.

The program—a massive load building effort—is designed to work in conjunction with electric utilities to increase the manufacturing industry's electrification.

Formulated last year by Westinghouse Electric Corp, Power-Up has set these targets for its 1958 campaign:

- To sell the efficient and profitable use of power.
- To sell electricity as a critical production tool.
- To provide industry with a solution to its profit problems—rising production costs, lagging production, skyrocketing labor costs, shrinking profits.
- To help industry meet today's needs while preparing for future growth.

The Power-Up idea began as a program of electric utility service. Its main purpose is to create a cooperative, massive load-building effort with industrial sales departments of electric utilities.


"can we afford to modernize?"
"it's cheaper than production losses!"
"it's the economical way to grow!"
so they began a step by step program to...
POWER-UP!

Through mass selling techniques, it stresses electrical planning by industrial management, plant operators, and supervisors to meet the needs of the future automated plant.

The 1958 campaign to Power-Up the nation's factories was launched with the address by A. C. Monteith at the recent convention of National Electrical Manufacturers Assn. Monteith, Westinghouse Apparatus Products vice president, declared:

"To say that American industry today is underpowered is an understatement. What good are all these dreams of electromation (or automation) and increased output if the very energy that is going to make all this possible can't even get in the front door?"

Monteith's statement was substantiated by a recent survey of 550 major industrial plants, which showed most of them had inadequate electrical facilities to handle the 40% production rise expected by 1965.

Specifically, the survey revealed that 100% of these 550 plants had inadequate main transformer capacity to meet demands expected during this period; 94% had no automatic load ratio control; 94% had no 277-v lighting; 89% lacked main substation bus protection; 85% had inadequate main breaker capacity; and 52% had low incoming voltage.

To remedy this situation, the 1958 Power-Up campaign is placing strong emphasis on electrical planning *today* to meet tomorrow's growth.

The campaign, backed by the entire Westinghouse regional sales organization, will highlight:

- Power-Up Road Show, sponsored by local Westinghouse apparatus distributors.
- Full scale industrial advertising on the benefits of industrial electrification.
- New material to aid utilities in selling Power-Up concept. This includes an apparatus training course; commercial modernization; and packages on automation, electric motor drives, industrial comfort heating, and sales training.

The Power-Up program evolved from an industrial power use information survey conducted by the Westinghouse Apparatus Division in 1956.

This questionnaire, which was answered by 90 utilities, sought replies to such questions as: "What is

Load Bonus

your No. 1 industrial sales problem for 1956?" (Answer: creative selling); "What is your No. 1 long-range problem?" (Answer: creative selling, area development, manpower, and load molding); and "What research projects could a manufacturer undertake in co-operation with utilities to assist in industrial sales efforts?" (Answer: market information).

The answers from these 90 utilities served as a guide in developing Power-Up. The effectiveness of the program to date shows up in another survey. Although the results cannot be considered completely accurate because many answers were submitted immediately following announcement of the program, it was found:

- Sales departments of 126 electric utilities have received the full Power-Up announcement program, others have had it explained to them, and some others have scheduled the meeting for this fall.
- Over 120 utilities have each been exposed to or chosen one of the first three package programs (Nos. 1, 2, and 3 in box). They've used them to educate personnel, to supplement sales plans, at trade shows and industrial forums, as part of inter-industry activities, and to sell industrial plants on modernization.
- At least 24 utilities have purchased the Modern Illumination Techniques course, eight others plan to.

Reception by utilities who have been exposed to the Power-Up program has generally been favorable. A number plan to use it as the center of, or as a supplement to, their 1958 sales campaigns. One customer called it "A program with teeth in it," while another plans to "hire one man to devote full time to this kind of sales promotion."

Here's What Power-Up Offers

Handbook of Cooperation—a listing of all available Power-Up promotional literature, films, and meeting materials

Packaged Meetings

1. "There's profit in planning your power distribution system"
2. "Electric heat—production's new dimension"
3. "Phantoms on the payroll" air conditioning
4. "Modern illumination techniques"
5. "Conditioned air—versatile tool for profit"
6. "Power-Up to stay competitive"
7. "Plant power through preventive maintenance"

Product application strip films

1. As introductions or refreshers on motors, dry-type transformers, bus duct, industrial heating, indoor distribution, circuit devices, or motor controls
2. The Legend of Amaquois Valley—sound color, now in preparation

Power Chek-Up Kit—Step-by-step procedure for a complete electrical analysis. Kit includes:

1. Diagrams of every power distribution and utilization situation in a typical plant
2. Calculator, giving kva, power factor, wiring capacity
3. Wire reference charts, listing types of insulation, conductor dimensions, wire sizes
4. Forms to aid the power analysis
5. Strip film and script demonstrating power analysis in a specific industrial plant

Plan of action for packaged meetings, including:

1. Direct mail folders, giving capsule story of meeting and benefits to be derived from attending
2. Invitations for meeting
3. Pre-promotion suggestions: package of information for local organizations (such as electrical leagues), professional societies, business paper and local newspaper publicity
4. Literature, product or system
5. Displays—traveling exhibits, stationary displays (floor or counter) on various products and subjects
6. Mailing lists—organized by function and locality, to simplify selective invitation
7. Plant tours

Utilities Spark Lighting Contest

First international competition draws 377 entries, 143 of them from pace-setting electric utilities. Prizes total $5,400 for 136 winners

How Winners Handled Their Installations

Richard C. Medcalf, Duke Power Co, had to ride herd throughout the installation of his first-prize residential layout. He coordinated work of the builder and a contractor who had no architectural installation experience to conceal wiring. Medcalf also had to corral the runaway ideas of a decorator. The home's architect-owner was sold on his professional and personal preferences and present and projected activities of his family. Lighting is keyed to a rectangular floor plan and strong horizontal influence of windows. Total connected lighting load is 7.65 kw.

Sales Engineer William C. Hoch, Jr, Philadelphia Electric Co, was called in by the manufacturer whose plant is seen below. The customer had relied on direct fluorescent fixtures but, with Hoch's impartial assurances on benefits of slotted industrial reflectors for the shop and a luminous office ceiling, the industrialist made the change. Hoch credits William Flurer, consulting engineer, for design and specs. The job permits flexibility of machinery layout where 100 ft-c is average intensity. Lighting load is 45 kw.

The pace-setting role of electric utilities in promoting and selling lighting has gained added evidence with the announcement of results on the 1957 International Lighting Competition. Of 377 entries received 143 came from electric utilities.

Utility representatives shared $1,280 of the $5,400 total in cash prizes. The first-prize power firm entries, which will be described in this and subsequent Electrical World issues, each won $100. In addition to the lighting jobs described at left, first-place utility awards were presented to:

Robert J. Huff, San Diego Gas & Electric Co, for store lighting; Henry Koether, Wisconsin Electric Power Co, office; Alfred C. Sangster, Detroit Edison Co, institutional; and Donald L. Roberts, Arizona Public Service Co, outdoor.

Second-place awards of $50 each were won by Roger W. Renkel, Union Electric Co, industrial; James Q. Miller, Consumers Power Co, store; John F. Dougherty, Hartford Electric Light Co, office; Alfred C. Sangster, Detroit Edison Co, institutional; Leon R. Case, Jr, Savannah Electric & Power Co, outdoor; and Mary E. Taepke, Detroit Edison Co, residential.

Wide Range of Entries

The first competition of its kind, the lighting contest drew entries from coast to coast and from The Netherlands, Australia, and Canada. Sponsors were Electrical World, Electrical Construction & Maintenance, and Electrical Wholesaling—all McGraw-Hill publications—and the National Lighting Bureau of National Electrical Manufacturers Assn.

Judging hinged on factors of sales effort, lighting adequacy, lighting quality, artistic appearance, and customer benefits. All types of indoor and outdoor installations were eligible with the proviso that jobs were completed between Jan. 1, 1956 and Oct. 25, 1957.

Utility Planners Wonder: 'Where Do We Go From Here?'

In the searching, sometimes-painful reappraisals of the nuclear power industry in the past few weeks, the big question for utilities has become "Where do we go from here?"

At least a partial answer is expected from a three day meeting starting tomorrow that the Atomic Energy Commission holds in Washington. Representatives of utilities, manufacturers, and consulting firms will explore AEC's long-range plans, the role of small power plants, cost factors, and component bottlenecks.

One year ago Strauss said the U. S. power reactor program had to be flexible enough to meet any and all changing conditions, and be subject to an annual review. In its sessions this week, the AEC will canvass industrial and technical authorities for opinions and suggestions.

The commission's fundamental philosophy has already been previewed by Chairman Lewis L. Strauss. At dedication ceremonies of the Sodium Reactor Experiment in Santa Susana, Calif., he described the purpose of the sodium-graphite reactor as one "which underlies the Commission's policy governing the development of nuclear power."

Research Comes First

Full-scale experiments are not warranted, he said. "First must come study and research, followed by experimental plants . . ." After that comes "first generation" prototype or demonstration plants of commercial size, he said. This policy "has proved its value."

There has been no AEC decision to stress the construction of full-scale nuclear power plants of any particular type in preference to other promising concepts, he said. "Nor is it our intention to abandon the proven principle of relying upon industry to exert its initiative to the fullest possible extent possible in development . . . of these larger demonstration plants."

He said assistance to industry should include research and development aid to American manufacturers in connection with plants designed and built by them in foreign lands.

W. Kenneth Davis, AEC's director of reactor development, told of the long road ahead of bringing benefits of economic nuclear power to the U. S. and abroad.

"It now seems clear," he said, "that the job we have undertaken will be harder and will take longer than many people at first expected. This is what led me to suggest in my talk in New York (EW, Nov. 18, p 76) . . . that we should perhaps concentrate more effort on what I called the 'water reactors,' to try to exploit them to attain commercially useful reactors in the next ten years or so.

"I did not say, nor did I intend to imply, that we should drop work on other reactor types, such as sodium graphite . . ." Davis said. "Far from it." While applying more money and manpower for "water" reactors, "we would need also to carry forward longer range programs for developing even cheaper nuclear power."

As for financing nuclear research, T. W. Locke, public utility research specialist for Goodbody & Co, had this to say before the Oklahoma City Economic Club Nov. 18:

Door Ajar to Federal Power

"The private utility industry may have to finance more of it or default to government-financed plants built with funds appropriated by Congress. This opens the door to more public power competition or growth."

Locke commented on the recent suggestion of Paul Hallingby, a Middle South Utilities Co vice president, that utilities allocate four-tenths of 1% of operating revenues for joint atomic power research. "This seems a good idea," Lock observed, but it would depend on the type, scope and method of the program, he added.

He suggested that an industry committee or group should be formed which included outstanding authorities within the industry and from large equipment companies. The group could plan the industry's atomic research "on a national scale in cooperation with AEC," Locke said. Every electric utility in the U. S. should take part, he said.

The need now, he continued, is more research. He foresees "much more experimentation with small plants" in the next two or three years. And the utility industry would benefit "by the dropping out of some manufacturers," Locke said.

NUCLEAR NOTES

Northern States Power Co has signed a contract with AEC for its 66-Mw plant. Advanced boiling water reactor will be fueled by slightly enriched uranium. Site may be near Sioux Falls, S. D. Estimated cost is $28 million including R&D.

AEC spent 62% more for reactor research and development in fiscal 1957 ($276 million) than in 1956 ($179 million). In the experimental power reactor field alone, costs for research and development jumped 24% to $56.7 million, and construtions costs rose from $9.4 million to $33.3 million. Under the power demonstration reactor program, the cost to AEC increased from $85,000 in fiscal 1956 to $1.5 million in 1957.

Russians, working toward a goal of 2 to 2½ million kw of atomic power by 1960, have started the first station in a new chain. Station will have two reactors each driving three 70,000-kw steam turbines for peak capacity of 420,000 kw. Pressurized water reactors will use a low concentration of U-235. The water, pressurized about 1,500 psi, will serve both as moderator and coolant.

Scientists are invited by AEC to contribute papers to the Second International Conference on Peaceful Uses of Atomic Energy, to be held in Geneva, Switzerland, Sept. 1-13, 1958. Deadline is Jan. 1, 1958.

At Memphis plant and across U. S. . . .

Steam Station Pace Steps Up

"An increased rate of construction" on Memphis' $121.5-million steam plant "is expected to result in completion as scheduled." This is the statement of Pres R. C. Roe, Burns & Roe, Inc, which is supervising building of the plant. The first of three 250-Mw generators will be installed by mid-October 1958.

Construction tempo remains high at other U. S. station sites. At Wisconsin Electric Power Co's Oak Creek plant unit No. 4 added 130 Mw capacity line recently and excavation has been started for No. 5. The coming unit will be a centerline-at-floor-level turbine-generator and operate at 2,400 psig, 1050F initial temperature and 1,000F reheat. It will produce 250 Mw and cost about $39.5 million, according to Allis-Chalmers Mfg Co.

A Detroit Edison Co addition at its River Rouge plant has upped system capacity above 3,000 Mw. The unit is a 260-Mw machine. A third unit of 320 Mw will go on the line in April 1958.

Construction is well underway in Bergen County, New Jersey, on a $107-million station. The Public Service Electric & Gas Co plant will generate 580 Mw when completed early in 1959. Its Westinghouse Electric Corp turbine generators will have two 3,600-rpm shafts that will drive main boiler pumps directly. Combined mechanical and electrostatic precipators will cut more than 98% of plant smoke.

Pipeline Under the Pacific

A 1,950-ft pipeline has been completed for the Los Angeles Dept of Water & Power's Scattergood plant. The 20 ft diam pipe beneath the Pacific Ocean will provide cooling water for the $61-million Scattergood. Piping cost was $3,026,000.

Production from the recently completed Indian River station will feed into the interconnected systems of Delaware Power & Light Co, Eastern Shore Public Service Co of Maryland, and Eastern Shore PS of Virginia. The 75-Mw station cost $17 million.

Central Illinois Light Co has acquired acreage for a $26-million LeMarsh plant. First unit will be a 125-Mw General Electric Co turbogenerator, which is scheduled for 1960 operation.

In Nashville, Tenn., power supply increased by 25 Mw when the third of four Old Hickory plant units went into service recently.

March, 1959 is the date Kansas Gas & Electric Co has slated for operation of a 166-Mw, $11.5-million addition at its Murray Gill plant in southeast Kansas. The utility also plans to build a plant at Colwich, near Witchita. The first unit will produce 165 Mw and ultimate plant capacity may go to 800 Mw. Construction is part of a $75-million expansion for the next four years.

Huge Hydro . . .

. . . project of 3,000 Mw is under study. British Columbia plan is rebuff to Washington, Ottawa 'pink teas'

Plans for a 3,000-Mw hydro development on British Columbia's Peace River have been revealed by Premier W. A. C. Bennett. He called the report for the $400 to $600-million scheme at Rocky Mountain Trench the "most momentous announcement" of his career.

A final survey, to be completed by the end of 1959, has been agreed upon by the BC Government and principals for Axel Wenner-Gren, Swedish financier.

If successful, it should mean that "development of B. C. won't be held back while Ottawa and Washington hold pink teas" trying to settle downstream benefits of the Columbia River, said Bennett.

The project would begin in 1964 to deliver power to Vancouver, 500 miles away. Engineering techniques "that aren't even in the books yet" would make the long transmission link feasible, the Premier said.

The project calls for a series of dams which would create the largest man-made lake in the world—260 mi long and 10-15 mi wide. By using the Peace, which flows into the Arctic, the controversy of fish vs. power on the Fraser would be eliminated. There would be no need to harness the Fraser.

Fund Drive Launched for United Engineering Center

The 20-story tower depicited here will become headquarters of 16 national engineering societies when completed in 1960. To be built on New York City's United Nations Plaza between 47th and 48th Streets, the United Engineering Center is expected to cost $10 million. It will serve as the hub of activities for more than 282,000 members of the various societies.

These highlights were revealed last fortnight by the United Engineering Trustees, Inc, which will allocate $2 million of its assets for construction. Society members are expected to contribute $3 million and industries, $5 million. The fund drive will continue through 1958.

Included among founder societies that will be headquartered in the proposed building is American Institute of Electrical Engineers. Associated societies include the industrial and consulting engineering institutes, and refrigerating, illuminating, heating and air conditioning, and electrochemical engineering societies.

The new center will replace the 50-year old Engineering Societies Building. Space is being planned for an enlarged library, meeting rooms, exhibitions, centralized services, private dining rooms and a cafeteria, and a possible Engineering Hall of Fame.

WASHINGTON WIRE

Politics Flare in Atom Exam

Joint committee on A-energy and AEC swap brickbats as question of federal reactor program resumes in Washington

A re-examination of this country's civilian atomic power program has begun in Washington under circumstances promising to aggravate the political controversy in this field.

First part of the examination came Nov. 21-22 when a subcommittee of the Joint Committee on Atomic Energy held a seminar with reactor designers and builders to determine what direction the program should take. Power companies weren't invited but will attend AEC sessions tomorrow (see p 51).

These investigations come at a time when the whole civilian atomic power program appears to be at turning point. Costs higher than anticipated have delayed the day of a profitable atomic power market for manufacturers and operators.

This situation is stoking up a political fight that has flamed for two years—the Democrats' push for a large-scale program of federal power reactor plant construction and opposition of the Administration and AEC, who urge reliance on utilities to build such plants.

The question now is should the push-up come through government construction or by greater federal financial aid to private industry?

When Rep Melvin Price (D-Ill.) chairman of the joint committee's research and development subcommittee, scheduled his meeting with reactor designers and builders, AEC officials said privately that the meeting was an attempt to "scoop" the three-day AEC December sessions.

The joint committee denies this, saying AEC, contrary to the law's requirement that it keep the committee informed, never described its proposed meetings.

Price avoided a specific account of the seminar but made these points:

- First and overriding need is for a clearly defined policy. It is AEC's responsibility, one which it has failed to meet.
- When policy with definite objectives has been spelled out it will be necessary to decide how to carry it out in best and fastest way.
- The $400-million government program proposed last year by Democrats was along right lines to get it done.
- Democrats are working on another big program this year. (While Price didn't say so, he, Sen Albert Gore (D-Tenn.), and Rep Chet Holifield (D-Calif.) began work on a bill after returning recently from Russia).

Safer Overhauls

Three recommendations for safer routine overhauls of generators have been put into effect by Duquesne Light Co as a result of a fatal accident at Reed Power Station (EW, Sept. 2, p 81). Proposals made by the investigating committee are:

- Assign the work of purging cooling hydrogen from generators to the operating rather than maintenance forces. Adopt the standard operating clearance procedure, including the listing of detailed procedural steps.
- Provide connections for density meter samplings at both top and bottom of the generator casing.
- Provide facilities for purging carbon dioxide with dry and de-oiled filtered air before opening the casing.

Russia Steps Ahead of Coulee

Full capacity has been hit at the Kuibyshev hydro plant on the Volga. It produces 2,100 Mw, surpassing Grand Coulee output by 125 Mw, the Moscow News reports.

Features of the U.S.S.R. project include provision for a foundation on alluvial soils, heavy consumption of water per unit of width in the tail race that reduced concrete work, separate rubbish clearing facilities that eliminate down time, and a new system of rapid filling and emptying of lock gates.

As of 1956 Russia's hydro capacity made up 19.5% of total power production vs. 5.1% in 1927, the paper said.

Talk About Load Factor

The 7,500 gas street lamps in narrow Philadelphia lanes and alleys now may burn day and night. The city council learned it could save $100,000 a year by doing away with automatic on-off controls that cost $29 per lamp a year.

Big Dam Deliberation

The proposed Paradise Dam, a $450-million project that would be built on Clark Fork River about 70 mi northwest of Missoula, Mont., is drawing stiff opposition again. Nine years ago Army Engineers shelved plans for the project because of local objections. A series of hearings last month aired more of the same from fishery, mining, railroad, and lumber officials as well as residents of the area. A. M. Chase, Montana Power Co vice president, said his company plans to build two "tax-paying" dams on the Flathead River if the 1,008-Mw Paradise project isn't built.

The City of Tacoma, Wash., still has hopes of building at least one hydro dam on the Cowlitz River although it has been forced to terminate a construction contract awarded two years ago. The optimism is based on gaining a U. S. Supreme Court review of a state court ruling prohibiting Tacoma from condeming a state game fish hatchery, which would be flooded by Mayfield Dam. Two offers have been made to buy the city's license and facilities. So far, $9 million has been spent at the site of the 345-Mw project.

Col Myron E. Page, Jr., suggested two compromises in the high vs. low dam hassel on Snake River projects. One possibility would be a higher Pleasant Valley dam providing 2-million acre-feet of storage and "extend water above the Hells Canyon site," the Walla Walla district engineer said. An alternative would be to change the proposed Mountain Sheep dam site in order to make it a storage project, he said.

Sputnik Spikes a Load Curve

Chief Dispatcher Clem Corey tracked the Russian satellite last month. During Sputnik's hasty flight between 6 and 7 AM over New England Electric System's area, load jumped to 419 Mw, 27 Mw over normal. Hours before and after Sputnik were normal.

Penn to Share in Relocations

Pennsylvania's State Superior Court has ruled that the Dept of Highways should pay 60% of costs incurred by Duquesne Light Co and a gas company for relocations caused by construction of a by-pass. The decision confirms a Public Utility Commission order. Observers believe the Highway Dept will appeal the ruling to the State Supreme Court.

Diggers' Delight

A remotely controlled excavating machine was demonstrated earlier this fall at a Cleveland grave diggers convention. The digger can be used for radioactive waste disposal, work on cliff edges, or other situations endangering an operator.

The machine uses an auxiliary hydraulic system added to a conventional 54 "f" model Sherman digger mounted on a Ford industrial tractor. Operator's messages travel from 12 push buttons through a 50-ft cable to actuate controls on the machine. Double-acting solenoids convert the electric impulse to hydraulic action. The invention is not being marketed yet. Sherman Products believes commercial versions should be adapted to radio control, which would eliminate the cable.

Resuscitation Positioning Stressed

EEI Accident Preventionists hear Dr. Kouwenhoven emphasize shock victim's posture to insure airway to lungs

"There is greater chance of saving a life during resuscitation when the shock victim's head is positioned to insure an airway into the lungs," Dr. W. B. Kouwenhoven, Johns Hopkins, told the Accident Prevention Committee, Edison Electric Institute, at Pittsburgh, Nov. 6-8.

Reporting for the resuscitation subcommittee, W. C. Bremner said studies showed that some victims received no air during administration of the back-pressure arm-lift (BPAL) or other methods of resuscitation in which his head is turned to one side and laid on his hands; twisting of the head closed off the air passages.

Tests Are Discussed

In the BPAL or other methods in which the victim is face down, said Bob Coleman, Baltimore Gas & Electric Co, his head should be placed straight out from the body in a "sniffing" position. This is done best by grasping his mouth and chin and pulling the jaw forward. The jaw should be placed on the victim's hands (with fingers interlocked). To maintain this position during BPAL resuscitation, the rescuer should keep his knees (or knee and foot) hard against the victim's forearms, especially during the arm-lift phase. Coleman said that the Red Cross in Baltimore emphasizes this position.

Dr. Kouwenhoven backed up the subcommittee's report with a discussion of clinical tests, in which 25% of test subjects received no air whatsoever when attention was not paid to insuring an airway to the lungs.

The same position is essential in insulfflation (mouth-to-mouth resuscitation) of all emergency cases, Johns Hopkins has adopted insulfflation for all emergency cases, where breathing has ceased. To counter possible hygienic shortcomings, a pharyngeal airway of pliable rubber can get air from the rescuer into the victim's lungs without mouth-to-mouth contact. This airway could be produced for a nominal cost.

Work on the portable defibrillator for field-crew use is continuing, said Dr. Kouwenhoven. Through the use of a high-discharge battery and transistorized circuitry, it is hoped to cut the unit's weight to 10 lb.

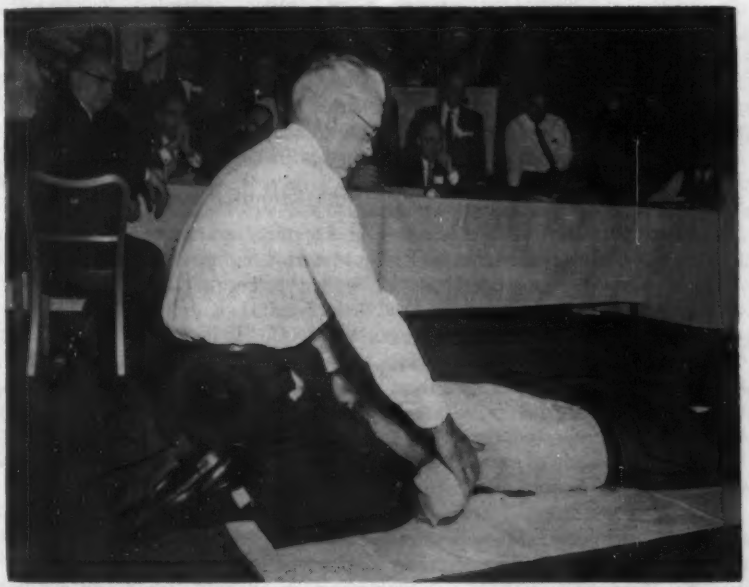
For lowering a victim from the pole, Georgia Power Co reported it has developed a cradle-type method which eliminates irritating or abrading the skin as a rope sling often does.

Summary of fatal accidents in the industry listed 97 reported fatalities in 1956, against a 16-year average of 129 per year. But analysis turned up the telling statistic that electric shock or burns still accounted for 72.1% of accidents, the 16-year average being 71.1%. Of the 70 shock or burn fatalities in 1956, 39 were suffered by employees in the 25-to-35 age bracket, and 32 by employees with 3 to 10 years of service. The Protective Equipment subcommittee reported that accidents due to failure of dielectric protective rubber remain infinitesimal compared to those due to contacts when rubber protective equipment was not used.

Stan Young, Hartford Electric Light Co, said violations of safety rules were responsible in most cases, ie, no rubber gloves in primary area, no "rubbering-up", failure to test for voltage and/or grounds. Such neglect implies a breakdown in the safety line of command, failure of people to remember safety rules, or a lack of supervision.

Cites A-Plant Needs

To make accident prevention at nuclear power stations an integral part of operation, said the atomic energy subcommittee, these avenues must be explored: Selection and training of personnel; preparation of operating procedures and coordination with safe practices; selection and proper use of monitoring devices; and, a continuing inculcation of safety awareness. For the present, at least, radiation protection cannot be evaluated by the average safety man untrained in radiation physics. This fact increases the importance of the health physicist in nuclear stations.



PROPER POSITION of the shock victim's head must be maintained during the administration of resuscitation. How it is done is demonstrated at EEI meeting

Pennsylvania Electric Association hears . . .

Utilities Will Spend Most on T&D

May boost investment 20% over that for rest of plant as mounting loads demand fresher thinking, says Penniman

Transmission and distribution plant will command a greater portion of the utility company's capital outlay, A. L. Penniman, Jr, vice president, Baltimore Gas & Electric Co, told the Transmission and Distribution Committee, Pennsylvania Electric Association, in Baltimore, Oct. 31-Nov. 1. This investment may increase up to 20% more than the remainder of plant.

New concepts are needed to meet increasing loads on an economical basis, Penniman said. Thought should be given now to larger ties between generating stations and to schemes for more capability per transmission channel. He suggested that because of urban right-of-way difficulties dc transmission for 1,500 Mw per circuit will be needed. Advance load planning, he said, will become more important as loads continue to increase 100% per decade.

Steps Prevent Tracking

Two steps may be taken to prevent tracking, the most difficult problem facing users of separated spacer-type aerial cable at voltages above 5 kv, said R. G. Raymond, Hendrix Engineering Sales, Inc. These are use of separators which space conductors at 6 in. and a 135-mil covering of polyethylene with a 15-mil jacket of irradiated polyethylene on each conductor. Tracking has caused burn-down failures of vinyl-covered conductors at 13.8 kv, he said. Below 5 kv, all troubles with separated aerial cable have been mechanical, one being incorrect sagging which leads to extreme conductor tensions in cold weather.

Use of three-sheave blocks for installing conductors for separated aerial systems has cut stringing time by one third and makes sagging easier, Raymond said. Three conductors may be pulled simultaneously with no braking required on pay-out reels. Some companies, he said, use the blocks for 250 to 300 ft spans on new lines.

Separated aerial cable 4-kv primary totaling 10 circuit-miles is used where no other type of construction was available and tree trimming was not practicable, said M. S. Jolley, Philadelphia Electric Co. Primaries consist of a 4/0-ACSR messenger and 4/0 all-aluminum phase conductors, with 3-in. spacing for vinyl-covered wire and 6-in. spacing for polyethylene-covered wire.

This type of aerial cable is easy to tap when energized, said Jolley, and only vertical deadening need be eliminated to obtain a neat circuit appearance. To protect aerial cable against lightning surges, Philadelphia Electric installs arresters where the cable is tied to an open-wire line. Jolley seconded Raymond's recommendation for sagging with due consideration for low temperatures, which may so contract the cable that plastic separators may be broken or torn from hangers at angles in the line.

High Retention Sought

Pressure treatment of poles and crossarms is moving back toward higher retentions of preservation, said Noel E. Kittell, Joslyn Mfg & Supply Co. It is designed to obtain 12 to 14 lb/sq ft retention plus penetration to sapwood. Woodpecker attacks on poles, he said, may be discouraged by copper formate, which forms a water-impervous, copper-cellulose complex showing promise of long life.

Failure rate of wood poles appears to be greater than is generally realized, said Sam Wood, South Penn Power Co. He suggested ground-line treatment as an answer. It is good practice, he said, to retreat full-length treated poles when they are relocated and it may be economical to return such poles to the treatment plant before re-use.

At least one stage of supplementary regulators, together with fixed and switched capacitors for 100% pf operation, is justified on 4-kv rural lines, said E. E. Wejman and M. W. Gangel, General Electric Co. Two stages of supplementary regulators make 4-kv lines useable in rural areas with heavier load densities where longer lines may be necessary. Greatest use, they said, will be in light-load-density areas.

Multiple Lighting Saves

Rapid growth of multiple street lighting on the Long Island Lighting Co system in the past decade was prompted by economy, safety, and simplification of operating and maintenance procedures, said John F. Hickson. Simplification of procedures is particularly significant because the company adopted and made wide use of higher (13.2-kv) distribution voltage as the multiple street lighting system expanded. The one disadvantage, Hickson said, is the high failure rate of certain control equipment and material.

Italy Orders A-Plant

Britain's first export order for an operational atomic power station, slated for Italy, will feature an improved version of the manufacturer's nuclear furnace. Nuclear Power Plant Co has designed a 200-Mw, one-reactor station for Italy which resembles its 300-Mw, two-reactor station being built at Bradwell, Eng. The $56-million Italian plant will run on natural uranium fuel. Graphite moderated, it will have a carbon dioxide gas heat transfer system to produce steam in probably six boiler units.

Handbook Editors . . .

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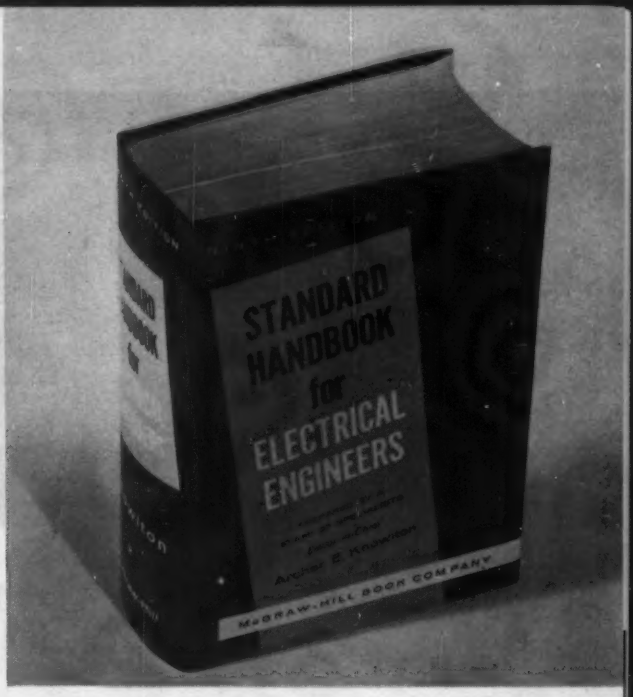


Standard Handbook for Electrical Engineers, Ninth Edition. Edited by A. E. Knowlton. Published by the McGraw-Hill Book Co, Inc., 330 West 42 St., New York 36, N. Y. 2230 pages, illustrated. Price $19.50

Revised "Standard Handbook" provides . . .

A Guide to Today's Electrical Art

Ten years have elapsed since the last revision of the Standard Handbook for Electrical Engineers, a decade of intense industrial expansion, paced by many changes in the engineering art. New techniques have been introduced, long-standing practices have become obsolescent, and steps taken to replace them.

The new ninth edition of this half-century-old electrical engineering reference has succeeded in recording the essential advances of its era without sacrificing the basic material that has made it acceptable over the years to student and practicing engineers. The result is a well balanced portrayal of the electrical arts today.

Among the scientific and engineering developments recognized in the revised Handbook are these:

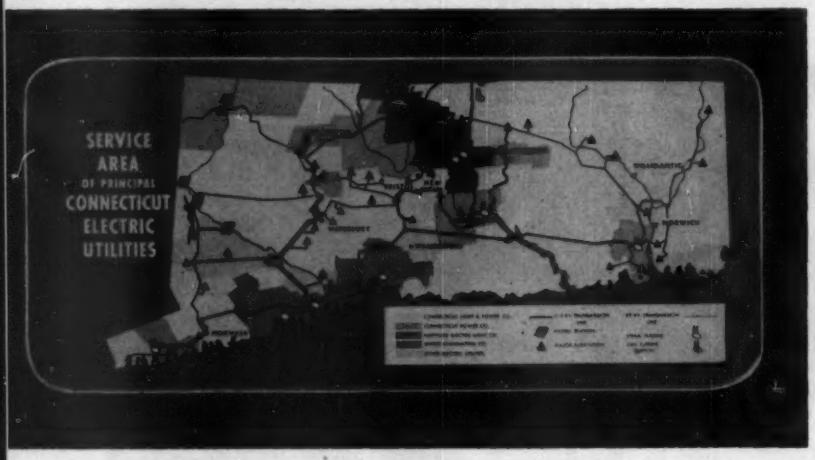
- New international measuring units have been introduced
- Nuclear technology has graduated from the area of physics to the practical science of power
- Plastics and resins have found new usefulness in electrical engineering
- Electrical conductor tables have been recomputed to conform to ASTM standards
- Growth of industrial automation has brought new skills to the electrical measurement of non-electrical quantities
- Modern telemetering has put new emphasis on methods of measurement
- Transistor techniques have emerged as a new phase of the electrical art

The new Handbook contains much that is new in the field of electrical engineering of power supply systems. Discussion of distribution system protection is founded on the new EEI-NEMA fuse link standards. Pole line design data embraces the use of aluminum conductors. Material on transmission has been extended to cover the new high voltages and the growth in the use of cable. Advanced practices and developments in the cooling of generators, the loading of transformers, and the protection of electrical systems are treated.

Completely new to the Handbook is a chapter on electric power from nuclear energy. Its content is as detailed as classification restrictions allowed at time of writing. It includes a discussion of the all-important economic position of nuclear power and offers a comparison of the cost of energy from a typical coal plant and a future nuclear plant. The pressurized-water reactor is covered in some detail and used to illustrate the general nature of the equipment and the mode of operation of a nuclear plant. A tabular comparison of other improved reactor designs under development covers their features, advantages, disadvantages, and state of development.

Gas turbines come in for revised and expanded treatment on performance and economics.

In presenting the new and the established reference material of the electrical art, the Handbook editors have recognized the special needs of engineers in an era of specialization. Today no one can follow all the details of a broadly developing art. In recognition of this the editor has fashioned a Handbook that offers the analytical engineer a uniquely tailored encyclopedia of engineering fact and practice that neatly spans the gap between his specialized knowledge and less familiar but related fields of electrical engineering.



Connecticut's

In the early days of our industry a company could count on falling operating costs through the improvement in the art of production and transmission of electricity—even the smaller companies. Today that is not the case. The rate of improvement in the last decade in the efficiency of steam generating units has been relatively small, and apparently the future holds no substantial gains. Moreover the efficiency improvements that have been realized lie mostly in larger sized units, unavailable to smaller companies who generate, as such units are out-sized for their system requirements.

This is the story of how four Connecticut electric utilities have developed a joint, long-range plan for reducing the cost of supplying their bulk power requirements without losing their corporate entities.

Connecticut's factories, homes, shops, and offices need ever-increasing amounts of electric power. Since the bottom of the depression, these needs have grown at a rate of 7.05% per annum.

4 Utilities Supply 95% of Connecticut's Power

About 95% of the power requirements of the state are supplied directly at retail (90%) and indirectly at wholesale (5%) by four companies: Connecticut Light & Power Co, Connecticut Power Co, Hartford Electric Light Co, and United Illuminating Co. About 50% of last winter's combined peak load of approximately 1,300,000 kw was accounted for by Connecticut Light & Power, and the remainder was divided nearly equally between United Illuminating and the interconnected system of Hartford Electric Light and Connecticut Power.

Each of these companies is a separate corporate entity specially chartered by the General Assembly of the State and whose business is entirely within the State. The systems comprise more than 700 miles of 69 and 115-kv transmission lines and 29 generating stations.

It has long been recognized that the major economic advantages which larger systems enjoy over smaller systems lie in the fields of production and transmission. To explore the possibilities of realizing some of these advantages, the presidents of our four companies appointed an engineering committee in the fall of 1952 to study how best to serve our combined future bulk power requirements as though we were "one-system." At the same time they appointed an implementation committee to study ways and means of implementing the results of the engineering committee's study.

The engineering committee, made up of the four engineering vice presidents, worked very closely together over a period of about 18 months. The challenge to this group was to come up with a plan or plans that would meet not only the requirements of the state as a whole but those of each company and would provide generating and transmission facilities adequate for the expected needs for the fewest dollars consistent with a high standard of service. And this, to be done irrespective of individual franchise territory lines.

In tackling this problem, this committee divided the work along the general lines of load forecasting, production, and transmission. The study did not concern itself with the distribution systems or with the purely internal transmission facilities of the four companies.

All known generating sites, both existing and potential, in the state were studied, together with the necessary transmission facilities for getting the power from the stations to the load areas. Inasmuch as the remaining undeveloped hydroelectric sites in the state are of minor importance, it was possible to concentrate on steam generation. Realizing that unit investment and unit operating costs decrease quite rapidly with increased size of steam generating units, these costs were carefully studied and the largest units that could be justified by the state load were worked into these plans.

A number of alternate long-range layouts for the combined system when it reached a peak load three times that of 1952 were studied using an ac network analyzer, and total annual costs for production and transmission

Joint Capacity Planning:

How It Works and What It Can Do for You

"Four can live as cheaply as one," says A. D. Barney, in describing how four Connecticut utilities are teaming up to cut bulk power costs. Their method: a one-system approach to planning additions of generation and transmission. The scheme was conceived five years ago. It has been developed in the interim. And tomorrow, Dec. 3, it becomes effective with the dedication of United Illuminating Co's Bridgeport Harbor No. 1 Unit. Barney, chairman of Hartford Electric Light Co, gave this speech recently to the Association of Edison Illuminating Companies

were worked out for several layouts showing good promise.

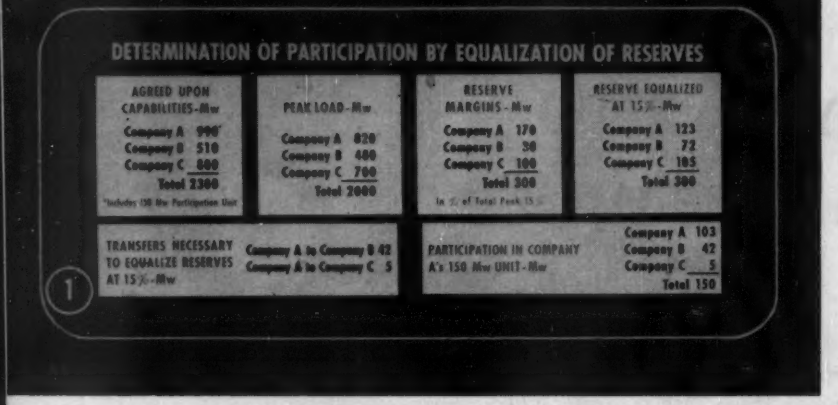
Both committees reported the results of their studies, and an overall set of principles was drawn up to guide the general program of coordination. This set of principles, which is the Magna Charta of our plan, is known as our "declaration of policy." Appendix A to this declaration of policy, which I will not read, actually sets forth the principles of participation and the charges.

Let us examine, briefly, how the whole plan works. The heart of this plan is the joint planning of generation and transmission using a one-system approach and the

"Declaration of Policy" for Capacity Agreements

For the purpose of developing the most effective bulk power system to supply economical and reliable electric power to the many communities they serve, The Connecticut Light and Power Company, The Connecticut Power Company, The Hartford Electric Light Company and The United Illuminating Company hereby mutually declare:

1. That the planning for the supply of this bulk power system should be coordinated, using a "one system" approach.
2. That the installation of additional generating capacity should be related to the combined loads of the interconnected systems of the companies affected. By mutual agreement, each additional generating unit should be, in so far as practicable:
   a. The largest size that the existing circumstances can justify.
   b. Timed to meet the requirements of the combined loads.
   c. Located and owned in accordance with two factors, namely:
      (i) The preferred location to serve the prospective combined loads, either in an existing or a new site, and
      (ii) Rotating installations so that in the long run no one company will have an unreasonable capital investment made for the benefit of others and no one company will be dependent on other companies for a disproportionate amount of its capacity requirements.
3. That the installation of and participation in each additional unit should be a separate matter to be mutually agreed upon. Participation in each unit should be on an "equalized reserve" basis in so far as practicable.
4. That under such a coordinated program additional transmission facilities and intercommunications may be required and that the cost of such additional facilities should be borne by the participating companies on an equitable basis.
5. That the accomplishment of maximum economy requires coordination of the operation of both new and existing facilities to the mutual benefit of all the companies concerned.



Four Companies to Build Larger

sharing of the resulting overall generating capacity on an equalized reserve basis.

Under this plan the participants will buy from or sell to each other such capacity as is required to maintain their respective percentages of reserve capacity at time of peak load, the same as the percentage reserve of the combined systems of all participants at that time. When reserves are equalized in this manner, it is obvious that each participant will have the responsibility for the same proportion of the combined capacity as his load bears to the combined load.

Here's an assumed example of how participation is determined by equalizing reserves (Fig. 1). In accordance with the declaration of policy, the next generating unit has been timed, sized, and located on a one-system basis. Here we see agreed-upon capabilities in Mw of Companies A, B and C with a new 150-Mw participation unit on the system of Company A and to come into service when the system reserve would otherwise be only 7½%.

This example shows only three companies because the interconnected systems of Connecticut Power and Hartford Electric Light have been operated on an integrated basis for many years, and these two companies are treated as one under our plan. Peak loads for the three companies are shown here.

In this example the reserve margins are 170 Mw for Company A, 30 for Company B, and 100 Mw for Company C, totaling 300 Mw—or 15% of the total peak.

Next, the reserve responsibility of each company is equalized to the system reserve of 15%. For example, 15% of Company A's peak load of 820 Mw is 123 Mw, and so on, with respect to Companies B and C.

We can now look at the transfers necessary to equalize reserves at 15%. In this case, we will have to transfer 42 Mw from Company A to Company B, and we will have to transfer 5 Mw from Company A to Company C.

Here, then, is the actual participation in Company A's 150-Mw unit. Equalization leaves Company A with 103 additional Mw, B with an increase of 42, and C with an addition of 5 Mw, which accounts for the total capacity of the single new generating unit.

In actual practice, a participation agreement is drawn up for each participation unit. This agreement binds each company to participate in this new unit in accordance with a formula which produces the equalization of reserves. Each company files estimates of its annual peak load for the next several years after the unit is planned to be in service and these estimates must be mutually agreed upon. In calculating actual participation, the agreements specify that the actual peak load or the latest applicable agreed-upon estimate will be used, whichever is the larger.

We assume that participation in any given unit will not be of long duration, providing load growth continues. Whenever the load of the company-owner of a participation unit grows to a point where the total capacity of the unit is required for such load on an equalized reserve basis, then participation ceases. The only continuing obligation under our plan is the agreement to supply power at cost by the other companies to the owner, in the event of a breakdown of such unit. This is necessary and fair because the participation unit will generally be over-sized for the owner's system.

Costs and Capacity Shared Alike

Each participant is entitled to the proportionate part of the capacity and energy output of a participation unit that its participation bears to the total net capability of the unit. Each participant is obligated to assume the same percentage of the fixed and operating costs.

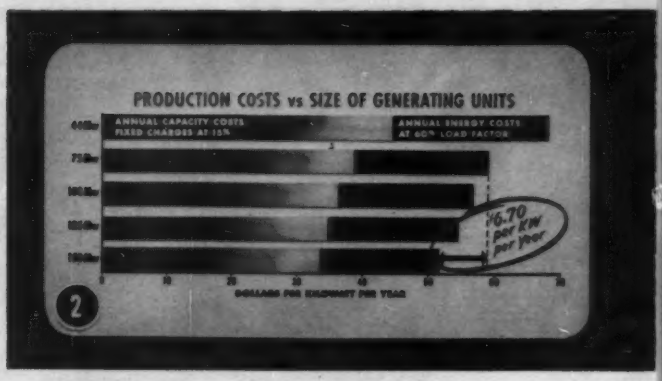
The factors entering into the determination of these fixed and operating costs are the expenses of investment or rate of return, depreciation, federal income tax, property tax, operation and maintenance, administration, and general overhead.

All of the factors above, with the exception of the fuel expense portion of the operation and maintenance expenses, are considered to be demand elements and make up the capacity charge. The fuel expense is the only factor considered in the energy charge. The philosophy of this type of cost determination is to assure the owner that after payment of all taxes and expenses the rate of return element will be carried directly through to his net income after taxes.

A unique feature of our plan is that all costs and benefits of participation are related to the participation unit or units. Inasmuch as participation units are always the latest units installed, all participants share in their efficiency and economy. On the other hand, each participant receives full credit for all his capacity, old or new, in calculating his participation amount.

After the framework of our plan—the declaration

Use One-System Approach Units, Cut Bulk Power Costs

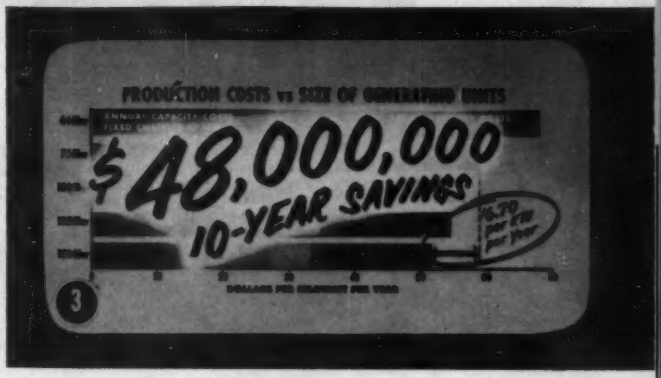

PRODUCTION COSTS vs SIZE OF GENERATING UNITS
ANNUAL CAPACITY COSTS FIXED CHARGES AT 15%
ANNUAL ENERGY COSTS AT 60% LOAD FACTOR
$6.70 per KW per Year
2

of policy—had been drawn up and agreed to, a top level committee was appointed to carry out the plan. This committee, known as the capacity coordinating committee, is composed of two responsible management representatives of each company and reports directly to the presidents of the four companies. It is charged with all phases of the overall coordinating problem, including forecasting of loads, coordination of system planning, determination of size, location and timing of new generating capacity, coordination of system operation, contractual arrangements, billing, etc.

Joint planning and contractual arrangements covering the first three participation units have been completed. The first unit in this program, which is twice the size of the next largest unit in the owning company's system, goes into service this fall. The second and third units are scheduled for service next year, and tentative arrangements have been completed for a fourth unit.

As an approximate measure of the potential savings of the production phase of our plan, let us assume that over the next 10 year period we supply our system growth by the installation of 150-Mw units rather than 75-Mw units. Here you can see the estimated annual cost of steam units of various sizes operating in our state at a 60% annual load factor (Fig. 2).

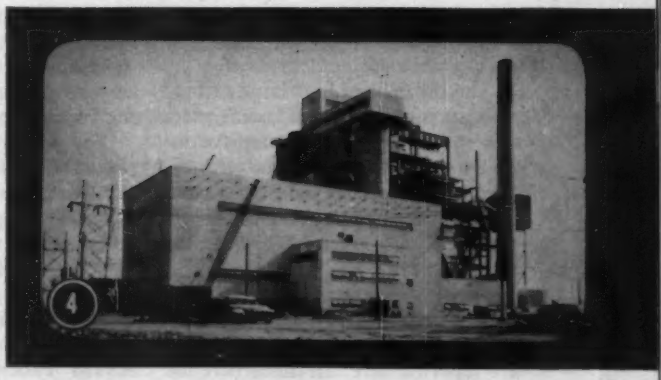
From this it is readily apparent that it costs less—$6.70 per kw per year to be exact—for a 150-Mw unit than it does for a 75-Mw unit. This is a saving of approximately 11%, and applying this unit saving to the cumulative load growth for the 10-year period gives an estimated saving in total annual production costs, including fixed charges, of $48 million (Fig. 3). The determination of the actual savings is not as simple as this, but we are sure that they will be substantial.

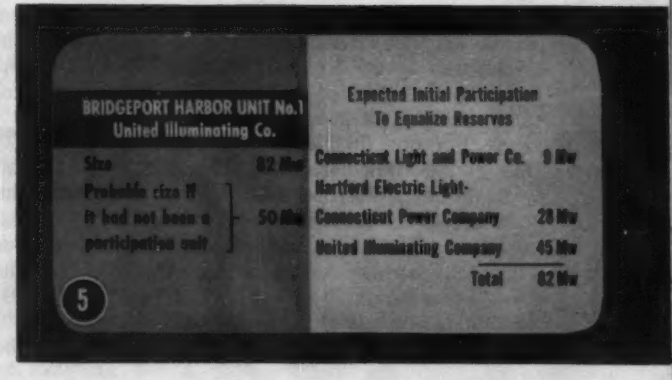


Additional production savings are expected to result from the coordination of system operation of the four companies and the interchange of economy energy which this coordination will produce.

Other economies will result from the coordination of transmission which is being carried out on a one-system basis. Referring, again to the map of the State, it is obvious that the transmission lines of one company pass through the service areas of other companies. We plan to take advantage of this in several places and serve the added load of one company from the transmission system of another.

(*Continued on page* 104)




BRIDGEPORT HARBOR UNIT No.1
United Illuminating Co.
Size 82 Mw
Probable size if it had not been a participating unit 50 Mw
Expected Initial Participation To Equalize Reserves
Connecticut Light and Power Co. 9 Mw
Hartford Electric Light-Connecticut Power Company 28 Mw
United Illuminating Company 45 Mw
Total 82 Mw
5

1 Investigations suggest that thin laminar silicate inclusions probably caused the bursting of the Pittsburg No. 1 generator rotor last March. The rotor body of this 170-Mva generator burst lengthwise into two half cylinders

Why Did Generator Rotors Burst?

Also tells how an investigation of the failures led to a significant advance in heavy rotor design and construction

A. W. RANKIN, General Electric Co, Schenectady, New York

The bursting of four large turbine and generator rotors in recent years was met promptly by extensive investigations by the manufacturers. They and the utility industry wanted to know, first, "Why did the rotors explode?" and then, "What can we do about it?"

Today the manufacturers believe they have answers to both questions. These, highly technical and complex, are reported here. In this article the rotor burst at Pacific Gas & Electric Co's Pittsburg Station is the cited example.

As unfortunate as the burstings were, they have led to a significant advance in the design, construction, and operation of heavy rotor forgings. For one thing, the capabilities of ultrasonic inspection, along with the mechanism of brittle fracture are better understood. Direct experimental evidence about the relationship between transition temperature as measured by the impact test and the resistance to brittle fracture of notched rotating disks is now available. And, disk bursting tests have demonstrated the value of maintaining maximum practicable operating temperatures on heavy, high-speed rotors.

The heavy-rotor development program, initiated following an earlier burst, has produced rotors of superior toughness, homogeneity, and quality. In this program, technical cooperation between the three large turbine-generator manufacturers and the five heavy-forging producers is established through an ASTM Task Force on brittle fracture. Rotor forgings of new compositions and heat treatments are evaluated, along with the effects of modification in steel-making practices, such as, the introduction of vacuum pouring of the rotor ingots.

Rotor Bursts on Routine Test

The generator rotor of the No. 1 unit at the Pittsburg station of Pacific Gas & Electric Co burst during a routine overspeed-governor trip test on March 18, 1956 after approximately 20 months of service on the system.

The rotor body burst lengthwise into two half cylinders, these subsequently breaking into smaller pieces (see Fig 1). Visual examination of the fractured surfaces indicated that the origin of the burst was an area about 5 in. long axially by 2 in. wide radially, very nearly on the axis about 30 in. from the collector end of the body. This 5- x 2-in. area (see Fig 2) had a "woody" or fibrous appearance with clusters of greenish-yellow particles typical of silicate-type inclusions.

Extensive microscopic examinations revealed that within this area the fracture was predominantly intercrystalline. Outside the area the fracture was transcrystalline with adjacent secondary transcrystalline shatter cracking.

This rotor was made from an acid open-hearth heat to a nickel-molybdenum-vanadium composition used successfully for rotors for many years. Review of the vendor's certificate of test showed that the composition conformed in chemical and physical properties to the long-established specification. Material tests performed after the rotor burst indicated that the properties of this rotor did not differ significantly from the many others which had furnished reliable operation over the years.

2 Fracture origin area had a "woody" or fibrous appearance. Clusters of greenish-yellow particles suggested the existence of silicate-type inclusions

Expert Gives the Answers

The before-service ultrasonic inspection of this rotor showed only scattered indications of 5 to 15% magnitude with two 25% indications in the vicinity of the 5- x 2-in. fracture origin. Because a 25% ultrasonic indication should correspond to a reflection area no larger than a dime, it was evident that the results of the before-service ultrasonic inspection did not correspond with the 5- x 2-in. size of the apparent fracture origin. Yet the predominantly intercrystalline fracture within the area and the absence therefrom of secondary transcrystalline shatter-cracking, indicated that most of this 5- x 2-in. area existed in the forging when it was received at the turbine manufacturer's plant prior to the before-service ultrasonic inspection.

Questions Are Resolved

Questions raised by these observations appear to be resolved by the results of ultrasonic inspection of the generator rotor in the station's No. 3 unit. The before-service ultrasonic inspection of the Pittsburg No. 3 rotor had disclosed 10 to 15 indications of 5 to 10% magnitude near the turbine end of the body. An ultrasonic inspection of this rotor after about two years of service, however, showed an indication of 40% magnitude in the same area. The actual maximum magnitude could not be determined because the inspection equipment then available could not probe through the slotted regions of the rotor.

To determine the cause of this ultrasonic reflection, a 2⅜-in.-dia core 32-in. long was trepanned from the axis near the ultrasonic reflection. This was found to contain a nearly continuous array of complex manganese silicate inclusions over an area about 1½ x 8 in. Metal in contact with the inclusion array was predominantly intergranular, again indicating that most of this 1½ x 8-in. area existed in the forging when it was received at the turbine factory. When the 1½ x 8-in. area was pulled apart, a fracture surface was obtained similar in appearance to the 2-in. x 5-in. area of Pittsburg No. 1 with numerous cylindrical filaments thereon of complex manganese silicates having a greenish-yellow tint.

The similarity between the inclusion array found in both rotors suggests strongly that a similar inclusion array existed in Pittsburg No. 1 and the resulting stress concentration at this point was the primary cause of the Pittsburg No. 1 burst. Points of similarity are the greenish yellow silicates, the visual appearances of the inclusion-array areas, the predominantly intercrystalline surfaces within the latter areas, the location of these areas within the rotor, and the minor ultrasonic indications observed in the before-service inspections. Still unresolved was the marked disparity in the sizes of the reflection areas implied by the minor ultrasonic indications of the before-service tests and the sizes of the inclusion-arrays actually found in both rotors.

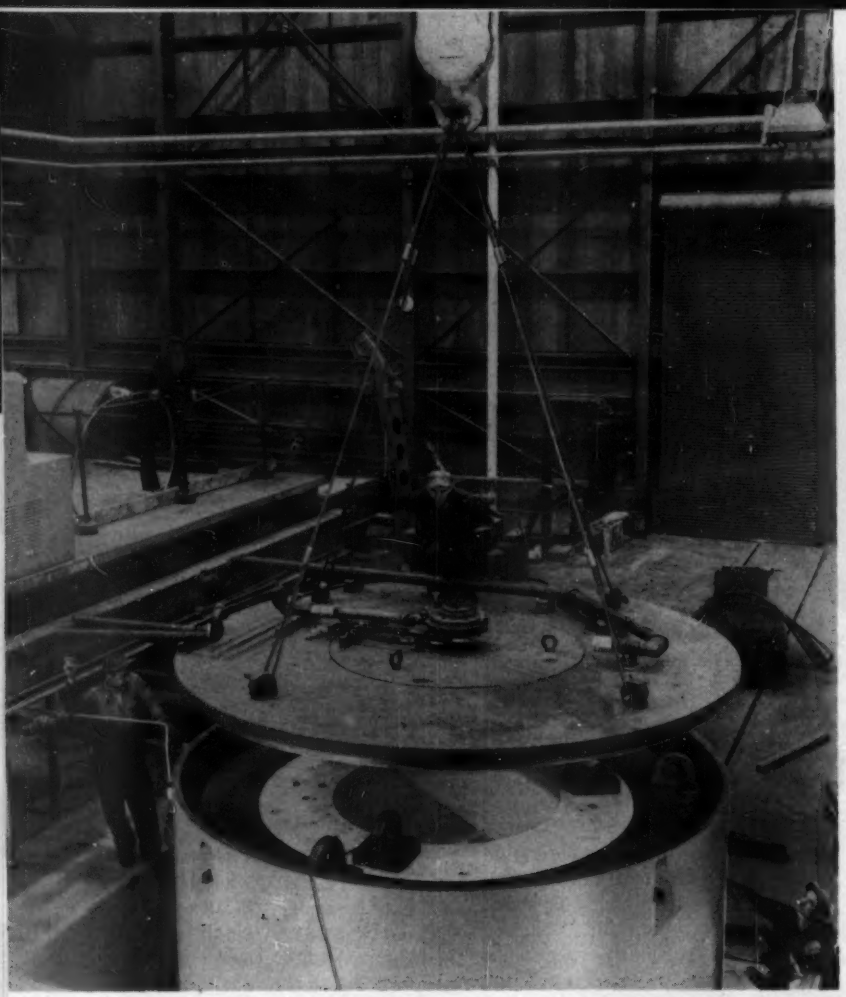
The core trepanned from the axis of the Pittsburg No. 3 rotor was subjected to nondestructive tests, and it was evident rather early in these that unusual results were being obtained in the ultrasonic inspection. Specifically, the length of the inclusion, as outlined by the ultrasonic inspection, was becoming greater on successive inspections, a growth from 5- to 8-in. being found between the original inspection and the final one weeks later.

Reflectivity Theory Studied

Theoretical studies of the ultrasonic reflection characteristics of an inclusion contained in a steel body showed that at very small values of inclusion thickness, the reflectivity is proportional to the square of the inclusion thickness, absolute reflectivity being dependent on the specific acoustic impedance and wave length of the inclusion material. Fig 4 shows the calculated reflectivities, up to the first maximum, of an inclusion in steel, assuming that the inclusion is: **1** a void (gas), **2** a liquid (oil), and **3** a solid (glass), all plotted against the inclusion thickness.

Theoretical curves indicate that whereas a void of 5×10^{-8} in. in thickness is detectable, a silicate of less than 10^{-2} in. in thickness is approaching invisibility to the commercial ultrasonic frequencies. Experimental studies simulating a thin laminar oil inclusion in steel verified the oil curve of Fig. 4.

The foregoing theoretical and experimental studies of reflectivity inclusion thickness were then applied directly to the inclusion of the Pittsburg No. 3 rotor. Microscopic examination showed the latter to have an average thickness of 0.005 in. and a maximum thickness of less than 0.010 in. The theoretical



3 Structural design data for large rotors is being obtained by conducting bursting tests on large notched disks in this very large vertical bursting chamber

curves (Fig 4) showed that a silicate (glass) of such thickness would be undetectable.

This inclusion array, however, would be detectable, were small cracks or micro-separations present within the inclusion or at the inclusion-steel bond. Specifically, when the inclusion was sound and well bonded to the adjacent metal, it would be difficult to detect as indicated by the theoretical silicate curve. But if subsequent handling of the specimen should cause microcracks within the silicate, it would become detectable in accordance with the gas curve.

Specimens were taken from regions of the trepanned core where high, intermediate, and low values of ultrasonic reflectivity had been obtained. Stereoscopic electron photomicrograph studies revealed that microscopic separations were present within the inclusion, such separations being most numerous in the specimens from the trepan sections giving the greatest ultrasonic reflections.

The foregoing theoretical and experimental studies indicate that thin laminar inclusions can occur in heavy forgings, and that such films will be difficult to detect unless they contain micro-separation. It is suggested that such inclusions might be of such a size as to result in rotor bursting, such as occurred on the Pittsburg No. 1 rotor.

Experimental and after-service ultrasonic inspections indicate that operation of the rotor at normal rotational speeds will form microseparations within such large inclusion arrays and make them detectable. Up to now, after-service ultrasonic inspections have been made on 30 generator rotors. Of these, 24 showed no change since original inspection; the remaining six showed changes in magnitude of indications. Five were bored and the ultrasonic indications thereby removed, and one was removed from further service. On new units, an ultrasonic reinspection is now made on all large generator rotors following factory balance and overspeed tests. No changes in ultrasonic inspection results have been found on 48 rotors subjected to re-examination.

Four Rotors Burst

Since early 1954, the American power-generation industry has suffered four turbine and generator rotor bursts. These were the burst of the Arizona generator rotor at Schenectady in March, 1954, the burst of the Cromby generator rotor of the Philadelphia Electric Co in Sept, 1954, the burst of the Ridgeland low-pressure turbine rotor of the Commonwealth Edison Co in Dec, 1954, and the burst of the Pittsburgh generator rotor in March, 1956. In each, the forging was of the nominal 2.75% nickel, 0.50% molybdenum, 0.10% vanadium composition which has been used by all the large turbine-generator builders in this country for these heavy forgings. This alloy, developed in the 1930's, had given reliable service until these bursts.

The structural design of turbine and generator rotors has been based to a considerable extent on the industry-wide spin tests of disks. These indicate that bursting occurs when the average centrifugal tangential stress approximated the tensile strength of the material. For commercial turbine-generator sets, such stresses would be reached only at high overspeeds, and the testing of disks with cracks and segregations did not show great loss of strength.

Rotors Burst Near Normal Speed

The actual rotor bursts, however, all occurred at near normal speed. And when investigations revealed that they all started at severe stress concentrations caused by thermal cracks, flakes, inclusions, and threaded holes, tests were initiated to evaluate the bursting strength of disks with severe notches.

Early in such investigations it was evident that there was a size effect not adequately revealed by tests of

small disks, even when geometrically similar to large notched disks. Accordingly, the investigation centered around the bursting of large notched disks. These disks, machined from actual rotors, were 24 in. in dia, between 2 and 6 in. in thickness, with two diametrically opposite 1-in.-deep notches cut into the 3¼ or 4-in.-dia bore hole.

With such severely notched disks, it was possible to simulate the "normal-speed" bursts of Arizona, Cromby, etc., and to determine the effects on bursting strength of such things as alloy composition, operating temperature, etc.

In a broad sense, room-temperature fractures of ferritic materials can be classified as either brittle or ductile depending on the reduction of area and appearance of the fracture surface. Brittle fractures can be obtained in any ferritic steel by using notched specimens under impact loading at low temperatures as in the Charpy impact test. In this, in which the fracture can be changed from brittle to ductile by simply increasing the temperature, standard notches are machined into small bars, and these are broken at different temperatures by a pendulum.

Nature of Fracture Changes

If the fracture surfaces are then examined, it will be found that within some relatively small temperature range, the fracture changes from completely brittle to completely ductile, for a rotor-alloy steel. While this test is interesting because it shows the only physical characteristic of steel which changes so rapidly with temperature, the significance of the results in machine construction not subject to impact or shock loadings was not understood until quite recently.

The Charpy impact test, and similar shock-loaded tests, do show, however, that operating temperature can modify the degree of brittleness in a fracture. Accordingly, several series of notched-disk bursts were made to determine whether moderate increases in operating temperature would increase the bursting strength. From these tests and similar considerations came the recommendation to maintain rotor temperatures at the highest practicable values, and, in particular, not to bring rotors to full speed when they are cold, especially in cold weather.

Data from bursting tests on notched disks of various alloys and heat treatments indicate that a decrease in the Charpy transition temperature is several times as effective in raising notched bursting strength as an equal increase in operating temperature. While for a given steel a 75F increase in operating temperature would increase the notched bursting strength by about 25%, a change in alloy, heat treatment, or steel-making practice which would lower the transition temperature by 75F would increase the notched bursting strength by a significantly greater amount.

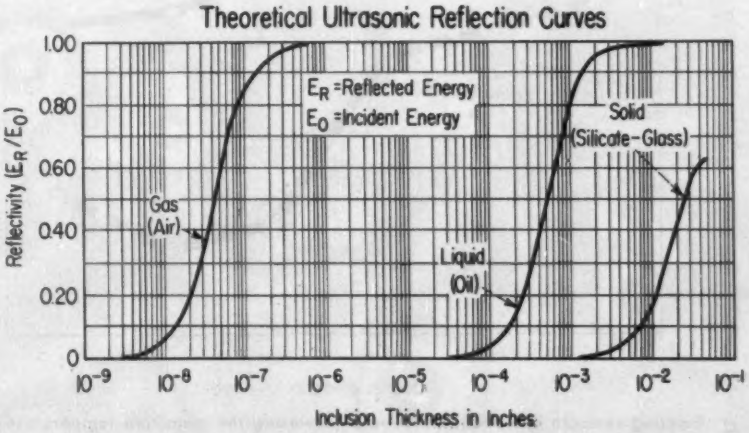
The general goals for the development of improved rotor forgings are: **1** A freedom from defects or cracks so that stress concentration areas are not present; **2** Homogeneity, so that uniform properties throughout the cross-section with freedom from alloy segregation is obtained; and **3** Toughness, or a low transition temperature, so that the rotor can endure without harm any unknown or undiscoverable imperfections. Because today's nickel-molybdenum-vanadium composition is in industry-wide usage, a task force on brittle fracture was formed under the auspices of the American Society for Testing Materials. This task force was formed through representation from the three manufacturers of large turbine-generator sets and five suppliers of heavy rotor forgings.

The production of a rotor forging in the sizes and strength levels for turbine-generator construction exemplifies the highest art of steel-making. To produce a single modern generator rotor may require the pouring of 300,000 lb of steel so that adequate top and bottom discards are available. These are needed so that the piping and major segregation, which occur as the molten steel solidifies and contracts, will not be contained within the forging proper.

Hydrogen Causes Trouble

During the heat treatment of the ingot, actual migration of various constituents can occur with resulting alloy segregation. The presence of hydrogen, formed from moisture within the furnace charge or taken from the atmosphere during pouring, at a level of only a few parts per millions, can render this huge mass of steel so delicate that spontaneous and severe cracking can occur unless suitable precautions are observed in holds at temperature and prolonged cooling rates. Because the soundness, homogeneity, and physical properties cannot be determined until the forging is completed—many months after the pouring of the ingot—it is evident that extreme caution must be observed before specifying any new composition, steel-making practice, or heat treatment.

The basic aim of the heavy-rotor development program is the production of sound, homogeneous, tough rotors at the strength levels and in the size ranges for modern large tur-



4 **Calculated reflectivities for different states of matter show that solids such as silicate-type inclusions must be relatively large in order to be detected**

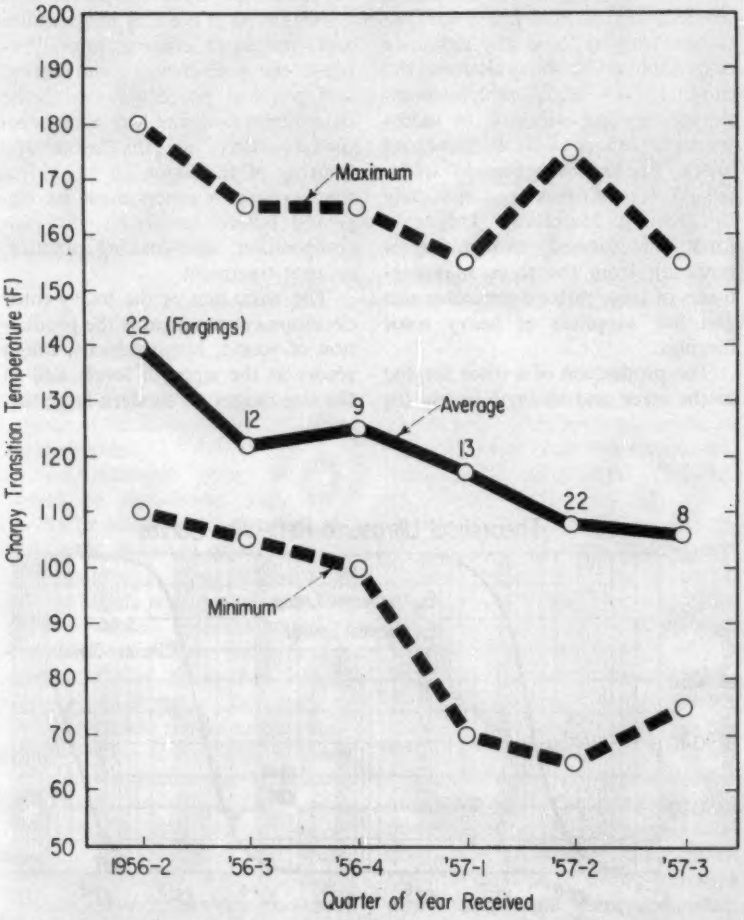
bine generators. All factors contributing to this goal are under study, particularly modifications of current alloys and heat treatments, and the evaluation of new alloy compositions. There have been many discussions with steel-makers in Europe regarding the steel-making and heat-treating practices for the alloys developed there for similar service. Vacuum pouring has been studied. Also considered are the future possibilities of the consumable-electrode method of ingot manufacture. In this, the ingot is built up by direct deposition from huge electrodes.

While all these activities are necessary for proper direction of the development program, the actual evaluation of the merits of any particular composition, heat treatment, steel-making practice, etc., can be obtained only by evaluations on full-size rotor forgings, as experience has shown that the metallurgical responses of the latter are often not reproduced in laboratory-size specimens.

When laboratory evaluations and discussions with mill personnel produced a promising alloy, heat treatment, or steel-making practice suitable for available mill equipment, an order was placed for a full-size production rotor. Because the great expense involved in a program of the anticipated scope dictated that such rotors be used for production turbine-generator units, it was necessary to schedule exacting and unusual inspections and tests on all rotors in the program. Accordingly, on each such rotor a massive prolongation was forged integral with one end. This provided the test metal for evaluation of the new alloy's properties.

At this time a total of 20 low-pressure turbine and generator development rotors had been ordered by the General Electric Co alone in this program. These will provide information on the merits of modifications of the present compositions and heat treatments, as well as evaluations of new alloy families.

Full water-immersion quenching from the 1,500F austenitizing temperature is specified on a number of rotors to evaluate the benefits of extremely rapid cooling. The properties available in the alloys and steel-making practices in Europe will be known from several rotors ordered from foreign suppliers. The merits of vacuum pouring of rotor ingots will be firmly established through the vacuum-pouring facilities available in American steel producing plants.



5 **Bursting strength has been improved by lowering the transition temperature Minor modifications of the rotor's alloy content helped make this possible**

Transition Temperature Reduced

At this time, 15 General Electric rotors on this program have been received. All have not yet been evaluated. Although some difficulties have been experienced, real progress in lowering transition temperatures without sacrifice of tensile strength levels has been made. Transition temperatures in the neighborhood of Zero F have been obtained on two rotors. Values below 100F have been obtained on several of the rotors.

Although it will be several years before vacuum pouring of ingots or superior alloy compositions can be used for all rotors, substantial progress has been made even with the air-pouring facilities and acid open-hearth furnaces from which many ingots must still be made. Fig 5 shows the reductions in transition temperature obtained over the past year by modifications in the nickel-molybdenum-vanadium alloy and its heat treatment. These improvements have been obtained by a reduction in molybdenum content. This reduces the tensile strength level somewhat, and a lowering of the austenitizing temperature together with improvements in steel-making practices at the steel supplier's plant.

How General Electric speeds turbine-generator production

Advanced machines and techniques improve General Electric's turbine-generator output

Expanded facilities will soon add to the production capacity of the large steam turbine-generator plant. Shown reviewing expansion plans are H. R. Hill, Mgr-Manufacturing, C. A. Lilly, Mgr-Marketing, and W. E. Saupe, Gen'l Mgr.

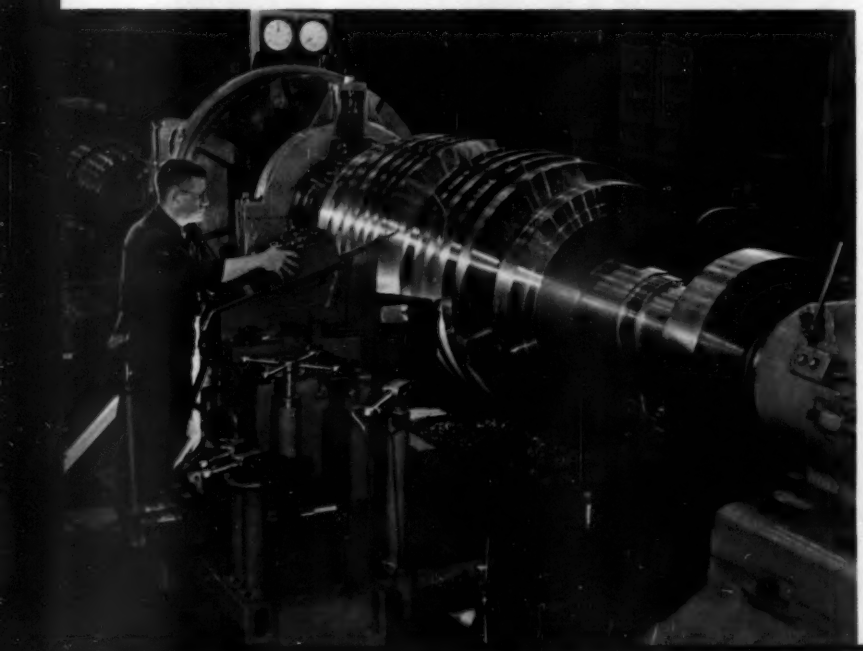
Meeting the requirements of the constantly expanding electric utility industry sets a challenge that is answered by General Electric's continued investment in its large steam turbine-generator manufacturing facilities in Schenectady.

New machine tools – some of them the largest ever made and the only ones of their type – add to the production efficiency required to build precision turbine-generator components, many with tolerances as close as those of a fine watch. Combined with General Electric's organization of skilled craftsmen and turbine-generator engineers, these tools and facilities provide the flexibility needed to keep pace with today's rapid advances in turbine-generator technology. And, in building tomorrow's even more efficient and reliable machines of advanced design, this combination will help maintain a well-established reputation for meeting delivery commitments.

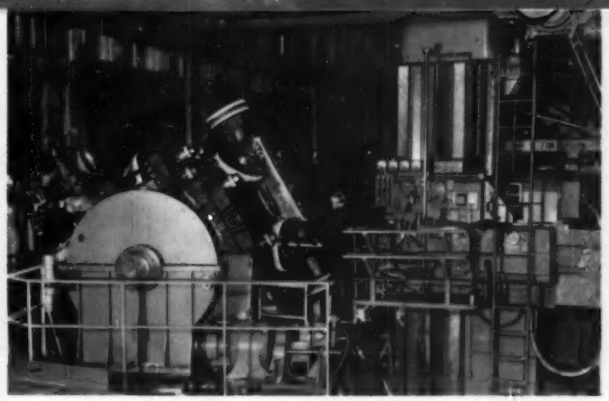
A few of the facilities in the large steam turbine-generator plant that contribute to these outstanding achievements are shown here.

GENERAL ELECTRIC

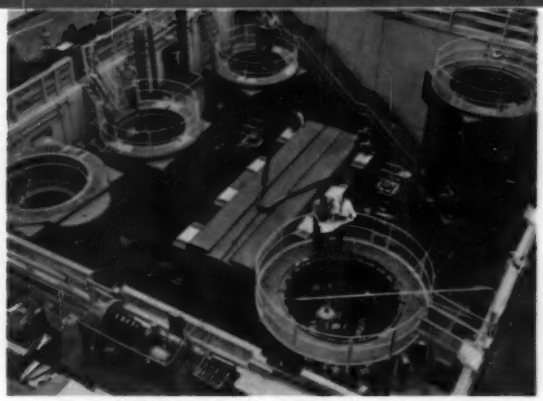
Grooving lathe removes metal from this turbine rotor at the rate of 100 cubic inches per minute – can take 25-ft forgings weighing up to 100 tons and is equipped to machine deep grooves up to 2½ inches wide.



Traveling reamer brings machine to job. Here, unit reams holes in turbine wheel and dovetails of 43-inch buckets.



Horizontal boring mill has special fixture for positioning and machining 100-ton turbine shells at complex angles. This unique arrangement considerably reduces set-up time.



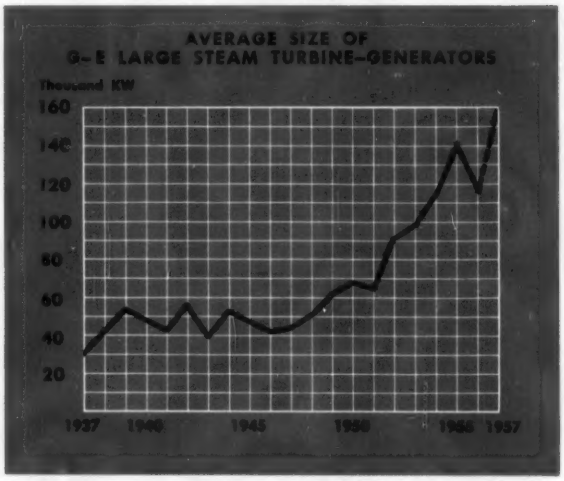
30-ft deep stacking pit accommodates six generator stators at the same time for stacking laminations. Each of the six stations has its own hydraulically operated press.

World's largest adjustable rail milling machine, capable of work equivalent to three 18-ft planers, saves time by allowing work to be set up on one table while machining proceeds on the other. Shown here machining a 225,000-kw generator stator frame, this mammoth unit stands 35-ft high, is 120-ft long and weighs 1,230,000 pounds.

General Electric is helping to meet tomorrow's power demands . . . today

To keep pace with the tremendous design advances of tomorrow's powermakers, new manufacturing techniques are continually being developed, and additional unique production tools are being designed and built. Already, electronic and magnetic tape controls are being applied to increase speed and improve accuracy of some machining processes.

Such forward-thinking investment in new tools and facilities for building large steam turbine-generators gives assurance that General Electric will continue to help the electric utility industry maintain its spectacular record of meeting the nation's constantly expanding power needs. Large Steam Turbine-Generator Department, Schenectady, New York. 254-54



Larger units, ranging up to 450,000 kw in size, are now being designed and built. Historical growth in average size of powermakers shipped from Schenectady is shown here.

Progress Is Our Most Important Product

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HOW TO

DESIGN • CONSTRUCT
OPERATE • MAINTAIN

TODAY'S DESIGN TREND

Stored-Energy Closing Halts Arcing on CB

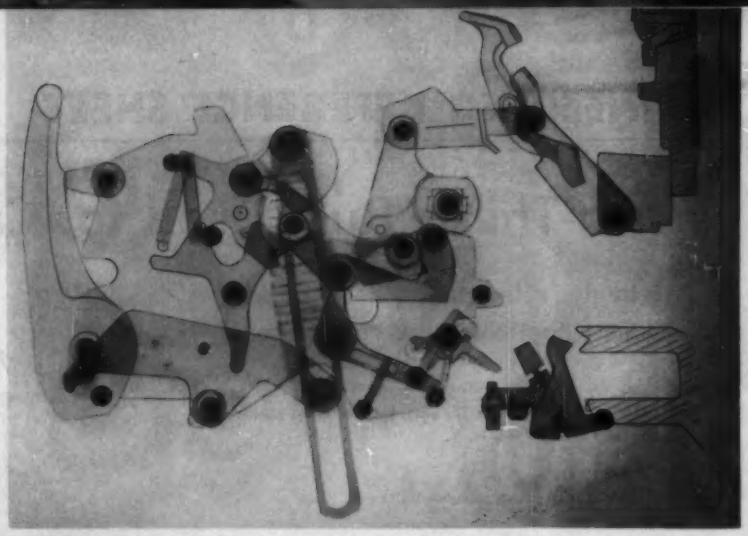
A stored-energy mechanism's quick, positive closing of a circuit breaker abolishes the arcing associated with manual closing. In its normal operating cycle, the mechanism receives and stores energy supplied by the operator's manual action. This energy is transformed into a closing force on the breaker contacts, and the breaker is latched closed. It can trip as required.

The mechanism assures fast closing of breaker's contacts to guard against arcing and contact erosion even under fault conditions when electro-magnetic force tends to oppose positive closing. Hesitancy at such a time would invite more destructive arcing which not only ionizes surrounding air but might initiate an internal short circuit.

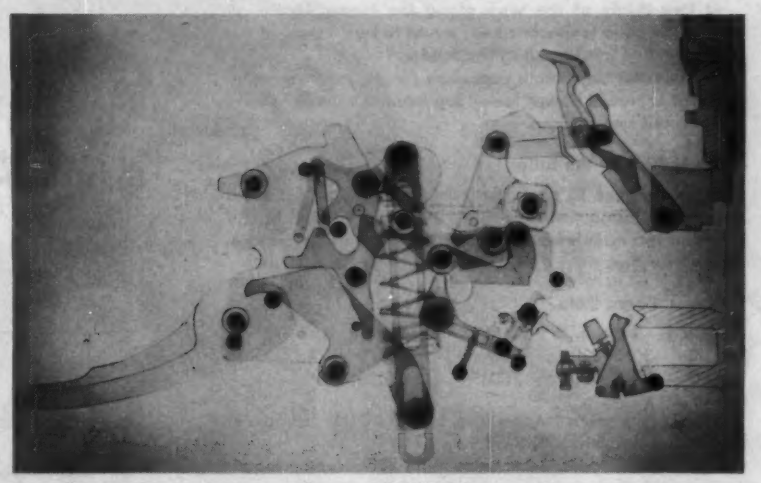
An I-T-E Circuit Breaker Co study determined the design requirements of a spring-powered, stored-energy closing mechanism as the following: Adequate closing power, high-contact speed, trip-free operation with high-speed opening, ease and simplification of operation, long life and low maintenance, compact size.

Further studies showed that a spring-powered mechanism meeting such requirements was generally feasible. When the closing handle of an open breaker is in the reset position, this operating sequence results: The operator's downward thrust of the handle supplies the stored energy and acts as a lever to force a cam to rotate clockwise. This action extends a closing spring downward, spreading the spring enough to snap the contacts closed.

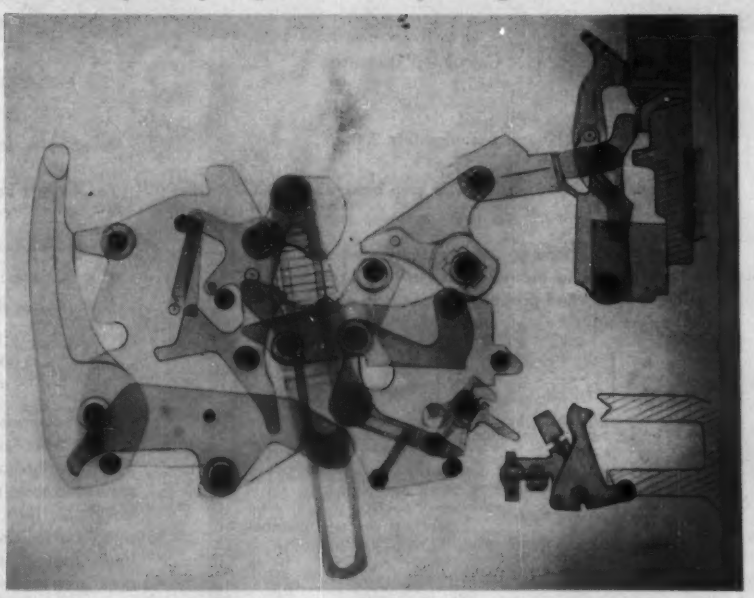
(*Continued on page* 104)



Breaker is in open position, spring mechanism normal



Breaker open, spring almost fully charged



Breaker closed, spring and handle back to normal

Two-Thirds Rule Used for Capacitor Kvar

Easy-to-apply rule can aid in rapidly determining shunt capacitor requirements

L. J. **RANKINE**, Applied Science Division, International Business Machines Corp, New York, N. Y.

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Rule

At two-thirds of the way along the feeder locate an amount of ckva (capacitor kva) equal to two-thirds of the kvar (reactive kva) input to the feeder.

This rule will help locate capacitors for an optimum combination of improved power factor, improved voltage conditions, and reduced system losses.

Application of the Rule

As an example to apply the rule refer to Fig. 1. Here a radial type distribution feeder is fed from substation A, and comprises two main branches BC and BD with more or less even load distribution. Using the "two-thirds" rule, the data are:

	Given Data		Correction Required	
Branch	Length, ft	Kvar	2/3 Length, ft	2/3 Kvar
BC	3,400	300	2,270	200
BD	9,000	700	6,000	467

Studying the correction required, branch BC needs approximately 200 ckva at 2,270 ft from B.

Assuming the standard bank size to be 225 ckva, the capacitor location will be found by using the relationship.

$$\text{Optimum Distance} = \frac{\text{Calculated ckva requirement}}{\text{ckva to be installed}} \times \text{Calculated Distance}$$

giving in this case,

$$\frac{200}{225} \times 2270 \text{ or approximately } 2000 \text{ ft}$$

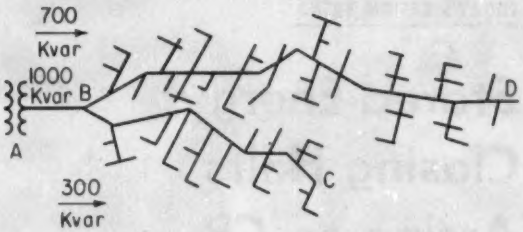
Thus branch BC should have a 225 ckva bank about 2,000 ft from B.

The case of BD is somewhat more complicated since 467 ckva is required, indicating the need for two 225 ckva banks. To locate these simply and properly, use is made of the previously published formula*:

$$x_n = L\left[1 - \frac{C}{K}(n - 0.5)\right]$$

where x_n = Optimum distance along feeder or section for n th bank
L = Length of feeder or section
C = ckva rating of bank to be installed
K = Kilovar input to feeder or section
n = 1, 2, 3 ..... n, depending on the number of capacitors of rating C to be installed

*Rankine, L. J. Place Shunt Capacitors to Save Line Losses, ELECTRICAL WORLD, Oct. 3, 1955, pp 96-97.



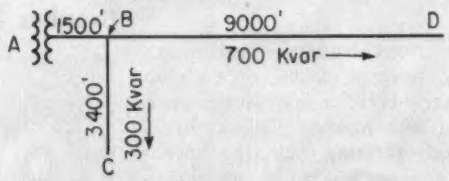


FIG. 1—Distribution feeder of radial type with two branches supplied from substation at A

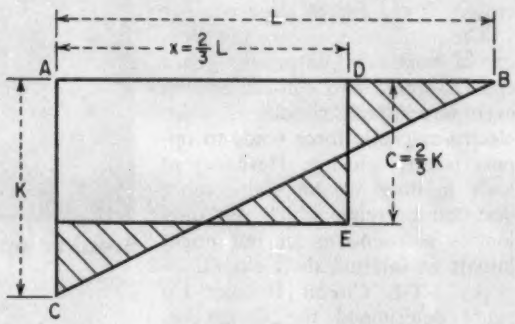


FIG. 2—"Two-thirds" rule in diagram form

For the first bank, writing n = 1, then

$$x_1 = 9{,}000\left[1 - \frac{225}{700}(1 - 0.5)\right] = 7{,}660 \text{ ft}$$

Similarly for the second bank, n = 2, then

$$x_2 = 9{,}000\left[1 - \frac{225}{700}(2 - 0.5)\right] = 4{,}520 \text{ ft}$$

Thus requirements for BD are: Locate one 225-ckva bank 4,520 ft from B, and the other 7,660 ft from B.

The mathematical derivation of the "two-thirds" rule is somewhat complex, but the basis for it can be seen by reference to Fig. 2. Here a uniformly loaded feeder AB of length L has a uniformly distributed kvar load K represented by AC. Under these conditions the maximum return in losses per unit of ckva installed will occur when we locate a bank of C ckva represented by DE at point E such that

$$C = 2/3\ K \quad \text{and} \quad AD = 2/3\ AB$$

Plates from REVERE for a BIG JOB

by C. H. WHEELER

Here you see two rolled Muntz Metal condenser plates, being drilled simultaneously in the plant of the C. H. Wheeler Manufacturing Co., Philadelphia 32, Pa. The plates were supplied by Revere. They measure 100-¾" x 203-¾" x 1-½" thick. Four plates were supplied for a Wheeler 2-pass divided water box unit having 95,000 sq. ft. of condensing surface. The overall length of the condenser, including water boxes, is 48 ft., and overall height, including steam dome and hot well is 34 ft.

Revere is an important supplier of plates and tubes for condensers, heat exchangers, and similar equipment, shipping to all parts of the country. Collaboration on alloy selection and specification is freely available. Just get in touch with the nearest Revere Sales Office.

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A Florida housewife winds up her mid-morning routine. Just before heading for the beach, she scrapes the excess from the greasy breakfast dishes, puts them in her automatic dishwasher, flips a switch and leaves for the sun.

A few hours earlier a similar scene takes place on Manhattan's smart east side. A chic career woman, off for a day of conferences, showings, lunches and cocktails, does the same thing.

In hundreds of cities and hamlets across the nation the story goes likewise.

Dishwasher Comes into Its Own

The automatic dishwasher, considered a few years ago to be a novelty that took more pains than it was worth, has come into its own. And this presents all kinds of opportunities for load-conscious utilities. With national saturation at a relatively low 4-6%, and every home a possible customer, they are moving in on what looks like a natural. In an around-the-country spotcheck of utility dishwasher activities, NEMA's Household Sink Units Section, has come up with a host of selling plans and promotions. Example:

New York's Consolidated Edison Co kicked off this fall what it termed "the biggest dishwasher promotion in the history of the industry." To back up its plans, Con Ed is spending some $300,000 of its own, and has picked up another $200,000 from manufacturers. Says sales vice president C. W. Meytrott of the big non-merchandising utility, "this is the biggest push ever conceived and will do for the dishwasher industry what the refrigerator promotion did for the refrigerator industry." Results are hard to measure, but at a recent Westchester Division press confab, a utility spokesman read off dealer sales results. All are up, and one dealer commented, "I'm sure Con Ed has broken down dishwasher sales resistance here. People who were only thinking about them last year are buying now."

Cincinnati Gas & Electric capitalized on studies of the Kentucky State Department of Health, which show dishwasher-cleaned dishes to be more germ-free then hand washed ones. In opening ceremonies, CG&E had its lobby (which became a "laboratory") lined with medical authorities from both Kentucky and Cincinnati; explained the study; and flashed on the screen pictures of actual bacteria counts. In addition, late model dishwashers were on hand for customer inspection, and continuous movies stressing other dishwasher benefits were shown. Total visitors the first day: 400. Commented CG&E promotion chief E. H. Hodgetts, "We are very pleased with attendance at our exhibit . . . it is our experience that people are greatly interested in dishwashers, and sales can be stimulated by well planned, interesting promotions."

FL&P Rounds up Dealers

Florida Light & Power Co recently completed its second local-level promotion to boost dishwasher saturation. The non-merchandising southern utility rounded up some 350 cooperating dealers in its 31 districts to help tell a half million residential and farm customers how dishwashers take the drudgery out of their lives. Using all media for maximum results, FL&P built its campaign around a "Look, Mom . . . No Hands!" theme. Sales goal of 1,000 units was exceeded by more than 500!

Washington Water Power Co held a three-month dishwasher campaign this year that added 60 units a week. The Northwest non-merchandiser teamed up with Inland Empire Electrical League whose membership counts some 15 distributors and 450 dealers. This campaign, too, used all media. Additional bonus: 296 dishwashers sold in the two months after the campaign, which company officials credit to their efforts earlier.

Other companies, too, are up in dishwasher sales. Central Illinois Public Service registered a 32% gain in the first seven months of this year. Pennsylvania Electric, in the same period, reports sales up 46%.

Sales Up in Promoted Areas

Although sales have jumped individually where promotion has been intense, the picture for the country as a whole reflects the generally downward slump common to most appliances in '57. Latest NEMA figures indicate sales for the first nine months of 1957 at 292,000 compared to 315,000 for the same period in 1956, a drop of 7.3%. The solution seems to lie with promotion.

Evidently dishwashers rank among the most appliances wanted by women. In past year's HFA "Women's Congress on Housing," held to find out what women want most in their homes, dishwashers sat high on the list. Chirped one Connecticut delegate, "the dishwasher was the greatest invention man ever made. No matter who provides it, it should be there."

The problem in getting it "there" is to find some effective way to show them how indispensable an electric dishwasher really is to them. It may be that a free home trial is the only best way to do this, but it is impracticable with under-the-sink units and its expensive. Utilities will have to help dealers on this one.

(*More Selling on page* 76)

NEW FROM VICTOR!

NO. 961 FOGBOWL SUSPENSION

Specially designed for fog and smog contaminated areas, this brand new product of VICTOR research was created to satisfy a critical need. The new No. 961 suspension has the *lowest* leakage current and the *lowest* radio interference level of any other type or make of fogbowl suspension insulator used in contaminated areas.

Low surge and leakage currents contribute to many desirable advantages of this insulator—particularly the elimination of wood cross-arm burning. These exceptional features have been proved not only in VICTOR'S own electrical laboratory, but by extensive service on lines in locations where contamination is a serious hazard.

If your service depends on protection against fog, smog and industrial contamination, here is your answer—VICTOR'S new No. 961 Fogbowl Suspension. You can't buy better—at any price!

VICTOR INSULATORS DIVISION

I-T-E CIRCUIT BREAKER CO., INC. • VICTOR, N.Y.

Ventilate and Heat
Your Manholes with
Mo Pe Co
Ventilating Heaters

GREATER EFFICIENCY
INCREASED SAFETY
BETTER PRODUCTION

300 to 800 CFM fresh air in summer, heated fresh air in winter. 160 watt generator attached provides current for lighting manhole simultaneously.

MODEL PE-G
Portable, PE-G weighs 70 lbs.
Electric models also available.

Write for illustrated brochure on complete line of our products.

Select Distributorships
Still Available

Morrison - Pelsue Co.

Dept. #10
2256 So. Delaware St.
Denver 23, Colorado

HEAT PUMPS now condition the offices in the existing Odd Fellows Building in Raleigh, N. C. CP&L salesman G. O. Green replaced coal boilers with 17 units

CP&L Trades New Heat for Old

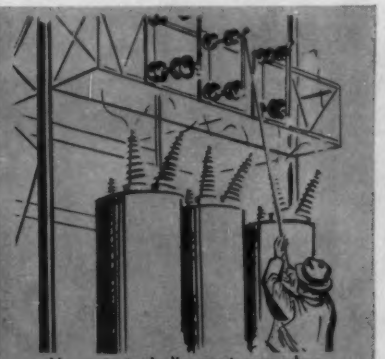
Heat Pumps (the "new") have won out over a coal-fired system (the "old") in an existing 10-story office building in Raleigh, N. C.

When one of the boilers in the Odd Fellows Building in Raleigh wore out, it had to be replaced. The order for a new boiler had already been placed when Carolina Power & Light commercial salesman G. O. Green heard about it. Green visited the building management and, with the cooperation of a local heat pump dealer, convinced them that heat pumps would be a better way to heat and air condition the old building. Green also talked other electrical conveniences. Results:

- Sixteen 5-hp heat pumps have gone in, totalling 69 kw.
- Strip heaters in the heat pumps add up to another 99 kw.
- Another 38 kw of strip heaters was put in the ducts of two already installed air conditioner units.
- A coal-fired water heater has been replaced with a 1,000-gal tank with a booster water heater operated at night with a time clock.

The installation of the heat pumps in an existing building of this size is the first of its kind in the Carolinas and possibly in the country, according to CP&L's trade magazine, The Spotlight. However, CP&L and the Odd Fellows do not feel they are experimenting. Although previous experience has been mostly with existing single-story structures or new multiple-floor ones, calculations in this case point to the wisdom of the decision. One big operating advantage: it won't be necessary to fire the entire system for one or two floors; heat pump zone control obviates this.

(More Selling on page 78)



No contact misalignment even when switch is operated from the side.

Easy operation even under severe atmospheric conditions.

How to judge the merits of

DELTA-STAR Hook Operated B-2K Disconnects

Consider each advantage offered by B-2K Outdoor Disconnect Switches in light of your specific needs. One or two advantages may stand out—or all may be equally important to you.

You are assured of *long service life* because of rugged, rigid construction, with flared or split tubular blades. This rugged construction also *prevents contact misalignment* even when operator must stand to one side to open or close the switch. *Easy operation at all times* results from efficient blade pryout and lock assembly, with large 3 in. diameter hook ring. The B-2K features *efficient heat dissipation* because ample material is used throughout. Contact pressure-applying springs carry no current, and offer large deflection to *maintain uniform high pressure* contact over extended periods of use.

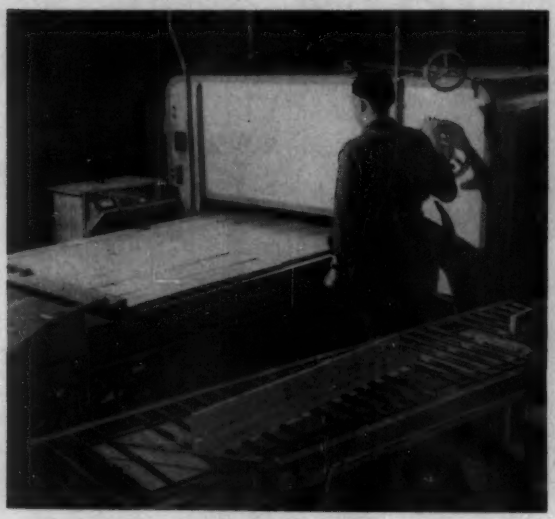
Delta-Star B-2K Disconnects are available in three ampere ratings—1200, 600 and 400—and in voltage ratings from 7.2 kv to 161 kv. They meet your requirements in every respect.

For complete facts, write for "B-2K Disconnect Switch Catalog." *Delta-Star Electric Division, H. K. Porter Company, Inc., 2437 Fulton Street, Chicago 12, Illinois.*

H. K. PORTER COMPANY, INC.

DELTA-STAR ELECTRIC DIVISION

Porter Divisions: Cleveland, Connors Steel, Delta-Star Electric, Henry Disston, Leschen Wire Rope, Quaker Rubber, Refractories, Riverside-Alloy Metal, Vulcan Crucible Steel, W-S Fittings, H. K. Porter Company (Canada) Ltd.



Oven dries edge-glued wooden strips to . . .

panel with joints strong as wood as . . .

High Frequency Trims Handling, Space Needs

GEORGE P. HITESHUE, Power Sales Engineer, West Penn Power Co, Kittaning, Pa.

A sharp reduction is glueing time, a lot less handling, small space requirements—these are the big benefits in a new, high frequency dielectric heater used to dry glued wood joints at the Crawford Furniture Company's factory in New Bethlehem, Pa.

Powered by a 15-kw, r-f generator, the new unit takes only 35 seconds to dry the glued wooden panels. With conventional methods, the same job takes 20 to 60 minutes, and ties up valuable floor space while the pieces dry.

In producing the wooden panels, strips of wood are edge-glued by an endless belt gluer located next to the dryer. The gluer is driven by a one-hp motor. The oven operator lifts the pieces off the gluer and joins them together on the conveyor belt which feeds them directly into the high frequency dielectric dryer.

A small control panel enables the operator to regulate conveyor speed and adjust the heat, holding the temperature to the desired level. Access door on the r-f generator is interlocked to shut off automatically if the door is accidently opened.

In addition to its speed, the high frequency heat produces joints that are as strong as the wood itself, and helps assure quality construction in the final product. The Crawford management feels the high frequency heat is fast, accurate, and dependable.

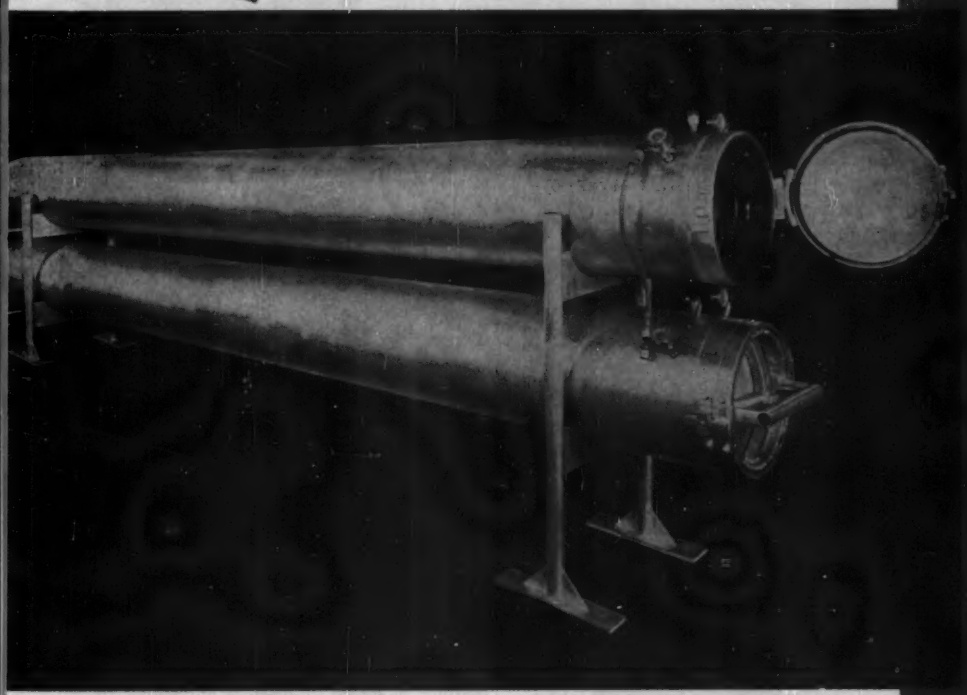
Heater Beats Humidity, Ups Output at Mirror Firm

A new infra-red heater only eight inches wide has solved a difficult laquer drying problem and boosted the production rate by 60% at J. H. Werbelovsky's Sons, Inc., Brooklyn mirror manufacturer. Used to dry the laquer finishes that protect the silvered backs of the mirrors, the new unit has increased the production line rate from 25 to more than 40 inches per minute. Space requirements are less than one-tenth those of the previous installation. The heater is unaffected by humidity and has eliminated the slowdowns and stoppages that "sticky" summer weather use to cause before the new unit was added.

The 7.5-kw unit operates from a 220-v a-c line. Known as a Velotron multi-frequency radiation heater, it consists of a coated alloy resistor surrounded by a non-metallic shield that passes 90% of the radiant energy. Two similar units are used to dry the silvered mirrors before the laquers are applied. The old installation was more than eight feet long.

The entire finishing and silvering operation is handled on a single line. Finishes are sprayed on with compressed air supplied by a 20-hp compressor. A 20,000-cfm exhaust system removes all the fumes from the area. In business for 92 years, Werbelovsky's Sons is one of the oldest and largest mirror firms in the country.

PURGE HYDROGEN-COOLED GENERATORS



WITH DRY ICE FORM OF CO_2 GAS

Dry Ice Converters Are The Most Convenient, Economical Source for Carbon Dioxide . . .

- **USED BY LARGEST ELECTRIC POWER COMPANIES IN THE UNITED STATES**
- **ELIMINATE HAZARDS OF MOVING GAS CYLINDERS IN AND OUT OF PLANT**
- **OFFERS LARGE STORAGE CAPACITY AT ANY CONVENIENT LOCATION INSIDE OR OUTDOORS**
- **UP TO 75% SAVING OVER COST OF GAS FROM CYLINDERS**

Dry Ice Converters are ASME-designed pressure vessels which are charged with standard-sized fifty pound blocks of solid CO_2 which sublime to gas and remain contained until needed. No refrigeration, power or attention is required. They are available up to 1000 pounds capacity (equivalent to 8700 cubic feet) and may be manifolded together by piping if greater volume is required.

Installations can be made vertically or horizontally any place that is convenient to plant layout, and with pressure regulator at converters, can be connected by low-pressure piping to locations of use. Thus the installation is permanent, and the hazard of handling high-pressure gas cylinders in your plant is eliminated.

Already in use in the largest electric power companies in the U.S.A., Dry Ice Converters have proved their worth by being re-ordered for use with added facilities. Plant executives have found that: besides the convenience and safety advantages offered by Dry Ice Converters, they can save up to 75% on CO_2 cost because dry ice in commercial quantities offers such a substantial price advantage over cylinder gas.

●

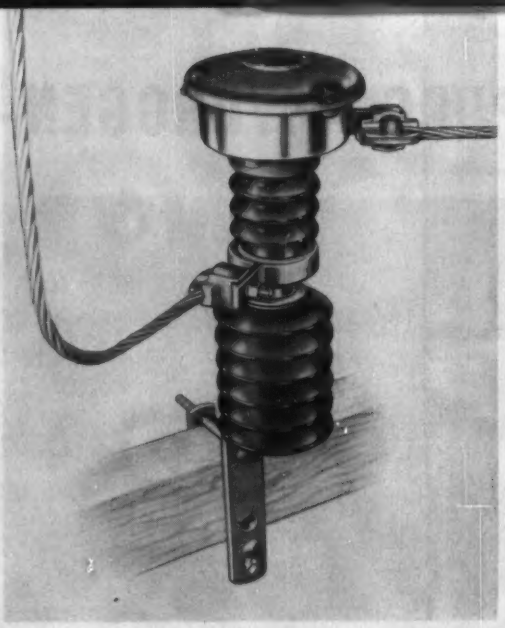
For further information on the applications of Dry Ice Converters to electric power company use, write or wire.

DRY ICE CONVERTER CORP.
TULSA, OKLAHOMA

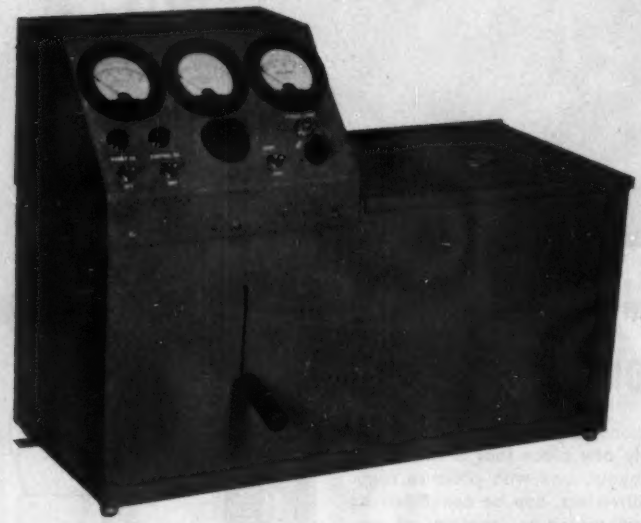
DRY ICE CONVERTER CORP.
DEPT. W BOX 1652, TULSA, OKLA.

NEW EQUIPMENT

Overvoltage Protector . . .



. . . guards series capacitor banks during faults. Internally, the self-clearing protector consists of a pair of gap electrodes and a spiral electrode. When arc forms across gap, thermal convection, emf, and motor action combine to make it rise into spiral electrode and whirl around inside housing and cover. This cools it, prevents excessive localized burning. When fault is removed, gap voltage drops and load current transfers back to capacitor bank. NEMA standard cutout mounting bracket hangs on crossarm.
A. B. Chance Co, Centralia, Mo.



Light Control Calibrator

. . . checks street light controls for calibration and circuitry in two min. This obviates return of control units for factory adjustment.

Daylight at dawn or dusk is simulated by a constant color temperature light, corrected with filters, and with a range of 0 to 5½ ft-c. Self-contained, continuously-indicating ft-c meter allows accurate reading of proper light intensity as determined by local conditions.

The instrument handles any photoelectric control device operating on 120 or 240 v, 50 or 60 cycles.
Micro Balancing, Inc, Garden City Park, L. I., N. Y.

Luminaire . . .

. . . for outdoor substation lighting has one-piece prismatic refractor made of thermally-stable glass. Bottom reflector and top cover are spun aluminum. Cast-aluminum fitter slips over 1½-in. pipe.

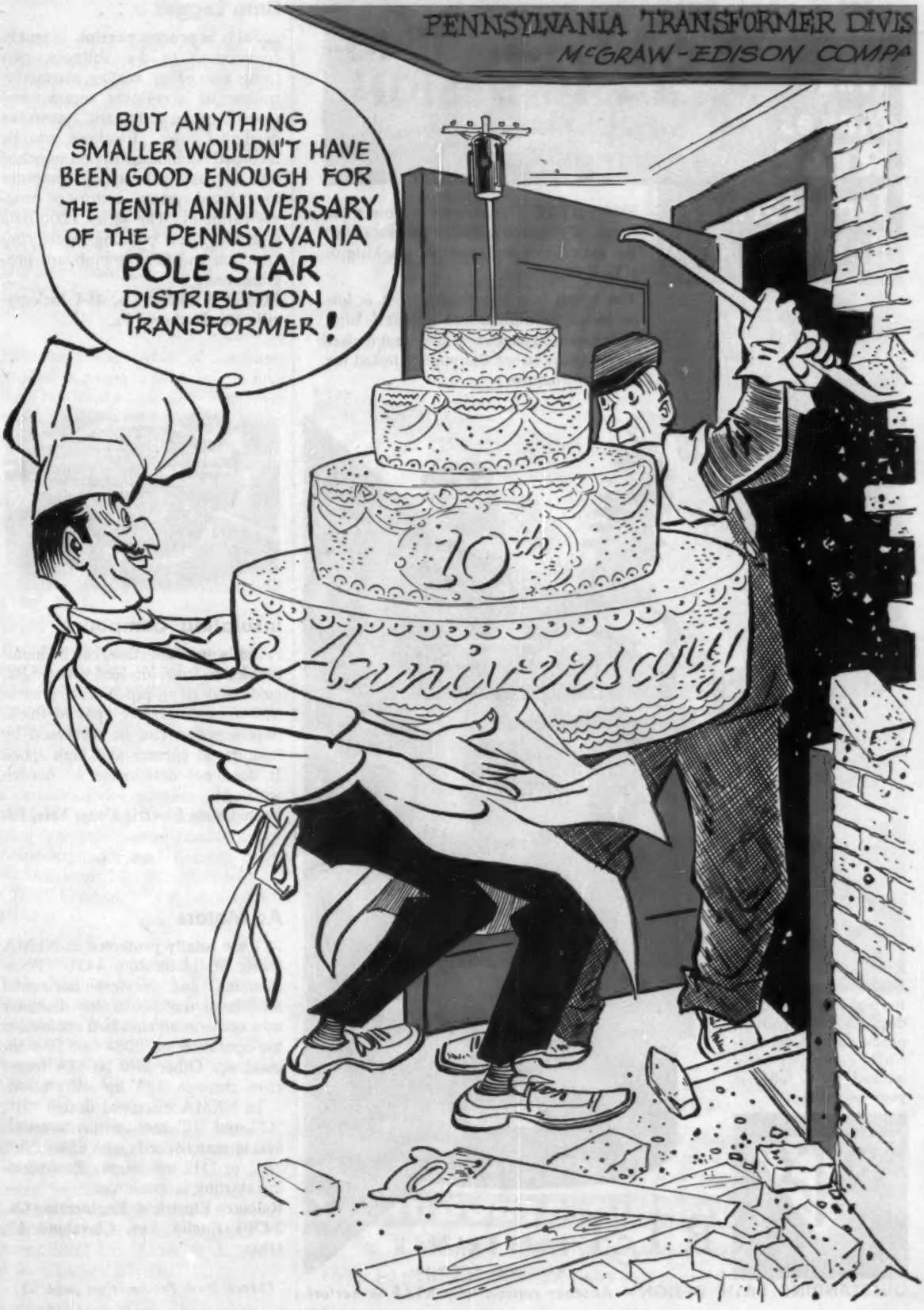
Height is 18½ to 20 in. Maximum diameter is 16⅜ in. Adjustable luminaire takes 250- or 400-w mercury vapor, 300- or 500-w incandescent lamps.

The luminaire features absence of glare and easy relamping, and requires little maintenance.
Holophane Co, Inc, 342 Madison Ave, New York 17, N. Y.

Interrupter Switch . . .

. . . is built for wall mounting where primary switching requires a metal enclosure. Main switch blade is equipped with a quick-break blade with tungsten tips which extinguishes all arcing in a plastic arc chute. Stationary break contacts have heavy spherical tips to protect current-carrying surfaces. Switch can be supplied for hook or direct manual operation. Ratings are 4.8, 7.2, and 13.8 kv, for 600-amp service.
R&IE Equipment Div, I-T-E Circuit Breaker Co, Greensburg, Pa.

(*More New Equipment on page* 82)


PENNSYLVANIA TRANSFORMER DIVIS
McGRAW-EDISON COMPA
BUT ANYTHING SMALLER WOULDN'T HAVE BEEN GOOD ENOUGH FOR THE TENTH ANNIVERSARY OF THE PENNSYLVANIA POLE STAR DISTRIBUTION TRANSFORMER!
10th
Anniversary

What Makes RT&E Transformers Better?

OUTSTANDING BASIC DESIGN

Easy to Install . . . Operate . . . Maintain . . .

Every RT&E Transformer combines the result of years of industry progress with the experience and creative thinking of RT&E Engineers.

The result is a transformer that is low on losses, regulation and weight — high in impulse strength and overload capacity. A transformer thoroughly tested for top performance.

RT&E Transformers are designed and built to the highest standards. A dependable product, produced by a dependable company and backed by a full five year guarantee!

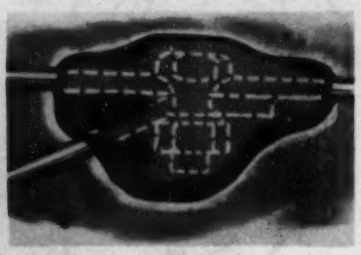
RT&E CORPORATION
WAUKESHA, WISCONSIN

OUTSTANDING BASIC DESIGN — *Another reason why* RT&E *is better!*

Data Logger . . .

. . . aids in process control. It makes conversions to d-c voltages, performs zero offset, scaling, characterization of non-linear inputs, and records on an automatic typewriter in digital form. Readings can be recorded simultaneously on punched tape for use with analog computer for "closed system" control of process variables. The series 1200 data logger features "building-block" construction and flexible pinboard programming.

Fischer & Porter Co, 464 Jacksonville Rd, Hatboro, Pa.



Insulating Compound . . .

. . . rolls on connection, can be hand-molded to form air- and water-tight, acid- and alkali-proof seal. Dielectric strength of 139 vpm in thickness supplied can be increased by lumping at corners and high spots. It does not deteriorate or harden with age.

Penn-Union Electric Corp, Erie, Pa.

Ac Motors . . .

. . . are totally protected in NEMA frame 364U through 445U. Foot-mounted and footless horizontal models in the 360 frame diameter now come in all standard enclosures for operation on 208- to 550-v in-plant ac. Other new NEMA frame sizes through 125 hp will follow.

In NEMA electrical design "B", "C", and "D", motors may be specified in many speeds with Class "A", "B", or "H" insulation. Part-winding starting is available.

Reliance Electric & Engineering Co, 24701 Euclid Ave, Cleveland 17, Ohio

(*More New Products on page* 83)

More New Products

Cab-controlled twin-hook **hoist carrier** with an auxiliary hoist for dumping has six-ton capacity. It hoists at 35 fpm, travels along tramrail at 250 fpm.—Cleveland Tramrail Div, The Cleveland Crane & Engineering Co, Wickliffe, Ohio

Fluorescent lamp has rare-gas filling. The 48-, 72-, and 96-in. sizes emit 6,000, 9,300, and 13,000 initial lumens respectively.—Westinghouse Electric Corp, Lamp Div, Bloomfield, N. J.

Lineman's underwear of urethane quilted in nylon is light, warm, and does not hamper motion. Washable and moth-resistant.—Arctic Insulated Clothing, Inc, 180 East Park Ave, Long Beach, N. Y.

Quartz infrared lamps are rated for maximum seal temperature of 800F. Available in 500-, 1,000-, and 2,500-w sizes.—Laine Electronics & Mfg Co, 91 Industrial Ave, Little Ferry, N. J.

Battery chargers feature toggle-switch selection of charging rate, timed charging period, and automatic reset to trickle charge.—Automatic Switch Co, Florham Park, N. J.

Compact **service entrance switch** has six fused pullouts in parallel and 24 plug-fuse branches to handle heavy home-appliance and lighting load.—American Electric Switch Div, Clark Controller Co, Cleveland, Ohio

Underwater **swimming-pool light** with 300- or 500-w reflector spot lamps is cast of chemical-resistant aluminum alloy. Lamps can be changed underwater.—Revere Electric Mfg Co, 6009-17 Broadway, Chicago 40, Ill.

Galvanized steel **framing material** for conduit, cable, switchgear, and controls has pattern of slots and holes repeated at 3-in. intervals. Material is measured and cut in one operation, then bolted together.—Acme Steel Co, 135th St & Perry Ave, Chicago 27, Ill.

NOW···GLOBE OFFERS···
two new INTERCHANGEABLE trays for support of cables, wiring and tubing

★ Engineered for uniform design and easy installation
★ Steel or aluminum construction
★ Complete accessories for SPEEDIER Installation
★ No sharp edges to damage cables
★ Complete interchangeability

Now, for the first time, two types of cable trays, one a ladder type and the other a basket type, are available to be used INTERCHANGEABLY at any given location, depending on the type and weight of the cables to be suspended. The advantages of each type tray can thus be used to the fullest extent. Globetray, the ladder type, is intended for use where festooning is not a problem, while Cable-Strut, the basket type, is intended for the support of communication wire, instrument tubing and control cables in automation applications.

These two cable trays have been thoroughly field tested in hundreds of large industrial installations, in new plant construction, in power plants, in modernization, and for power distribution in all types of manufacturing processes. A new catalog, just off the press, gives full information and installation techniques. Ask for your FREE copy today.

Distributors are to be found in all principal cities—consult the yellow pages in your phone book under "Gratings" or "Conduits" for the one nearest you.

109

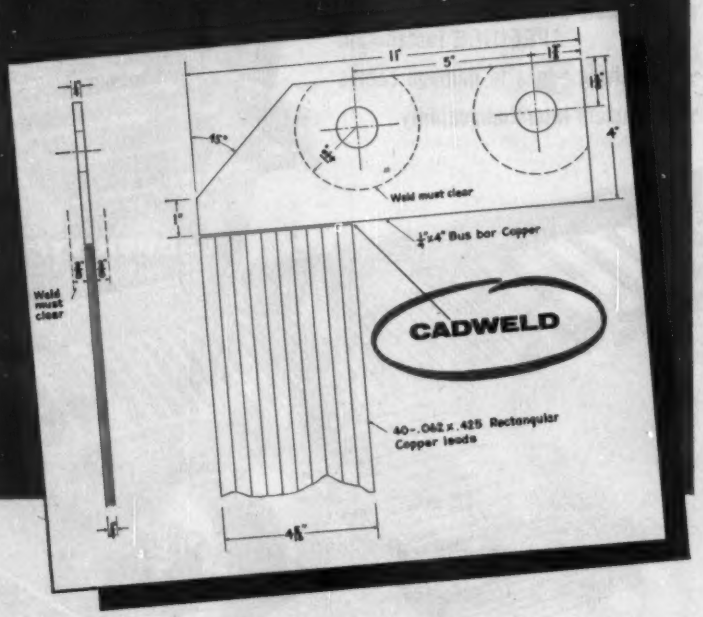
PRODUCTS DIVISION

The **GLOBE** *Company* MANUFACTURERS SINCE 1914

4030 SOUTH PRINCETON AVENUE, CHICAGO 9, ILLINOIS

just say

CADWELD®



Architects, Engineers and Contractors specify "CADWELD CONNECTIONS" to insure a 100% efficient electrical system for both grounding and power requirements.

CADWELD Field Engineers are located throughout the United States and Canada.

NEW CATALOG available on letterhead request.

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Erico Products, Inc.

2070 E. 61st Place Cleveland 3, Ohio

IN CANADA: ERICO INCORPORATED, 3571 Dundas St., West, Toronto 9, Ontario

CATALOGS–BULLETINS

• **SOLVENT:** Properties and uses of Chlorothene, a low-toxicity solvent for spray cleaning of electrical equipment, are described in a 16-p booklet from Dow Chemical Co. Get copies from any Dow sales office, or write Solvent Sales Dept, Midland, Mich.

• **HOURMETERS:** Catalog No. 600 (12 pp) from John W. Hobbs Corp of Springfield, Ill., a Div of Stewart-Warner Corp, gives details on ac and dc engine hourmeters.

• **TUBE DATA:** A 650-p "Engineer's Handbook" containing data on over 1,000 tubes along with 300 characteristic curves is available from CBS Tube distributors.

• **ADJUSTABLE SPEED DRIVES:** Drives from fractional to 3 hp can be selected with a plastic slide-rule-type device available through General Electric Co Apparatus Sales Div district offices.

• **BLAST CLEANING:** Selection and application of hand-operated blast-cleaning machines is the subject of a 28-page bulletin from Pangborn Corp, Hagerstown, Md. Ask for No. 100C.

• **DIELECTRIC CORE OVENS:** Bulletin 657 from The Foundry Equipment Co describes full line of ovens to cure synthetic-resin-bonded cores with r-f power. Write Dept 6D, 1831 Columbus Rd, Cleveland 13, Ohio.

• **INDUCTION HEATERS:** An 8-page bulletin from Magnethermic Corp, 3990 Simon Rd, Youngstown, Ohio, describes 60-cycle units for induction heating of metals.

• **INSTRUMENTS:** Two bulletins are available from Sensitive Research Instrument Corp, New Rochelle, N. Y.:

Contact Making Deflection Instruments for the production testing or automatic acceptance or rejection of manufactured materials or components (4 pp).

D-c Ammeter, heavy current, direct reading (2 pp).

• **POWER PACKAGES:** Units to keep truck and radio batteries charged are described in 8-page "Mobile Installations" folder (Form F-111) from D. W. Onan & Sons Inc, Minneapolis 14, Minn.

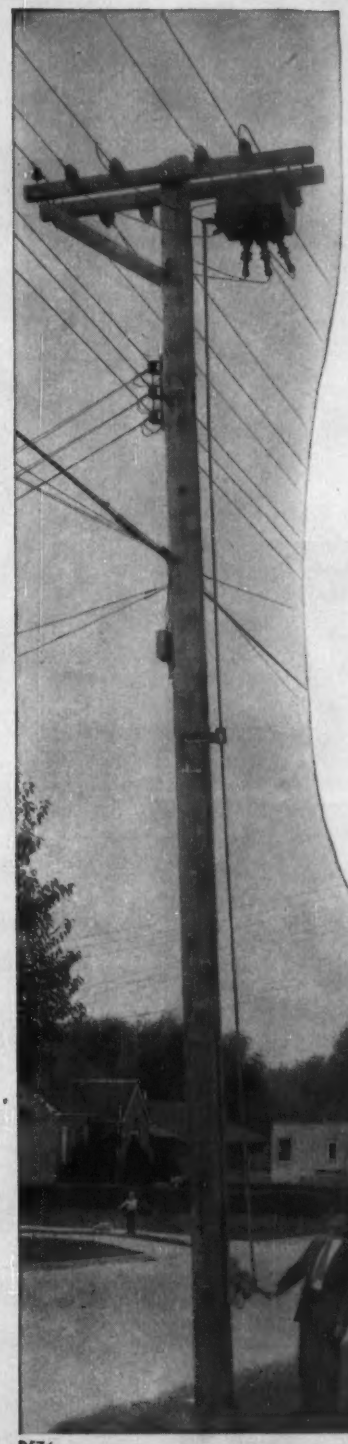
• **MISCELLANEOUS:** Bulletins listed below are available from Heiland Div, Minneapolis-Honeywell Regulator Co, 5200 E. Evans Ave, Denver 22, Colo.:

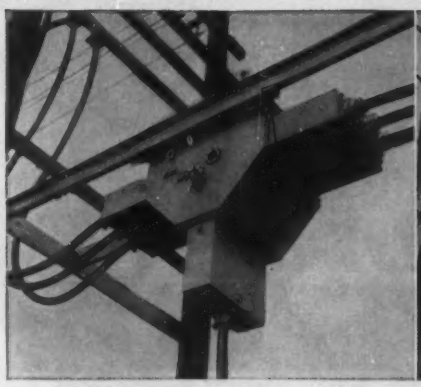
Amplifier Systems for static and dynamic recording are discussed in Bulletin No. 101 (8 pp).

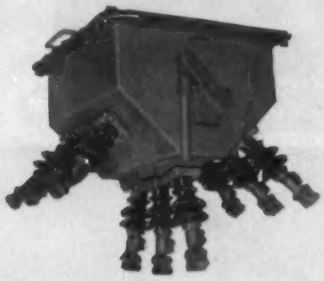
Sub-miniature Galvanometers are discussed in No. 301 (12 pp).

Oscillograph, series 700C, is fully described in the 12-p Bulletin No. 701.

Bridge balance & strain indicator unit is the subject of No. 801 (4 pp).







"ORAD" *Double Throw*

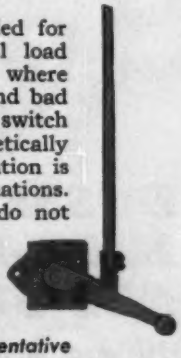
"ORA" *Single Throw*

for full load break sectionalizing of overhead circuits

***install* G&W TYPE "ORA" OIL SWITCHES**

SWITCHING CONTACTS IN OIL FOR PROTECTION AGAINST CORROSION

Type "ORA" oil switches are recommended for sectionalizing overhead circuits when full load break disconnection is an advantage and where protection against atmospheric corrosion and bad weather conditions is important. With all switch links and contacts oil immersed in hermetically sealed tanks, permanent trouble-free operation is assured under normal and emergency situations. Snow, ice, rain, or temperature extremes do not affect the operation.



400 AMPERES—5 Kv. and 15 Kv.

Write us or get in touch with our nearest representative for further information.

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3500 W. 127th St. BLUE ISLAND, ILL.

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Also manufactured in Canada by Powerlite Devices, Ltd., Toronto, Montreal, Vancouver

D574

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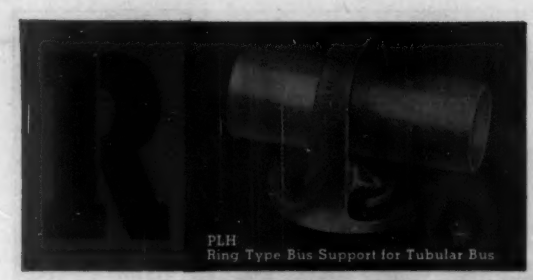
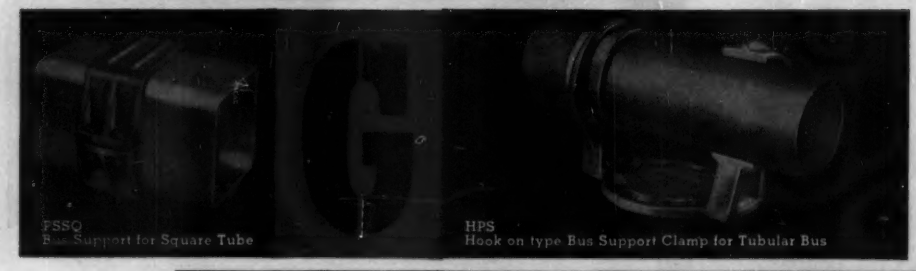


PLH
Ring Type Bus Support for Tubular Bus

SBC
Sliding Bus Support for Tubular Bus



FSSQ
Bus Support for Square Tube

HPS
Hook on type Bus Support Clamp for Tubular Bus

CS
Bus Support Clamp for Cable

PSS
Tubular Bus Support Clamp

DOSSERT HIGH-STRENGTH BUS SUPPORTS

SHV
Vertical Bus Support Clamp for Flat Bar

• Higher cantilever strength • Higher impact resistance
• Higher corrosion resistance • Greater durability

These Dossert Bus Supports are made of a high tensile strength cast bronze alloy and are equipped with silicon bronze bolts and nuts, making the entire unit completely non-magnetic. Available for all sizes and types of busses. Dossert Bus Supports can also be furnished in Coupling, Tee Connecting, Elbow Connecting, Tee Coupling and Expansion Connection types.

SAV
Vertical Bus Support Clamp
for Flat Bar

Special fittings and modifications can be readily supplied on short notice.

50 YEARS OF TECHNICAL LEADERSHIP

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249 Huron Street, Brooklyn 22, N.Y. • Representatives in all principal cities
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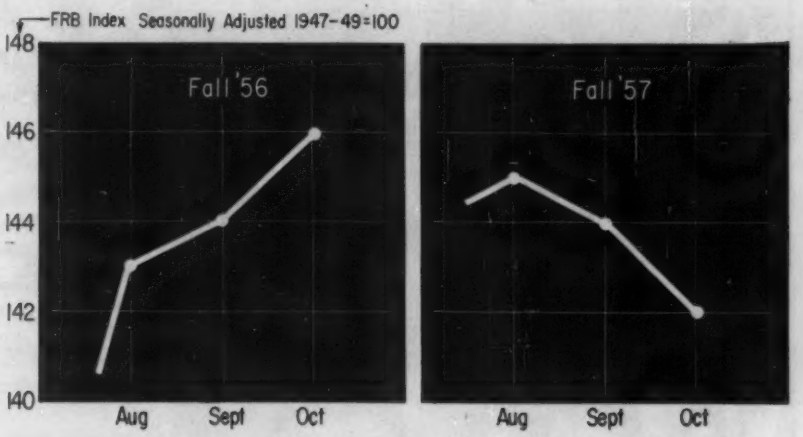
ELECTRICAL BUSINESS OUTLOOK

Electrical World
DECEMBER 2, 1957



Industrial production sputters at 4th quarter's opening

The Fall Fizzle: Omen for '58?

Latest trends in industrial production aren't too heartening. Output in October slumped to 142 on the FRB index—off 2 points and down to the lowest level so far this year. Compared to the year-end spurt in '56, 1957 seems to be winding up on a really weak note. Overall output is down 5 points from last December.

In fact, most of the economic indicators reflect the business lull. Employment didn't take its usual seasonal spurt in October, and personal income dropped off by a full $1 billion. Steel production is way off. Department store sales are sluggish. Even Detroit has started to worry a bit.

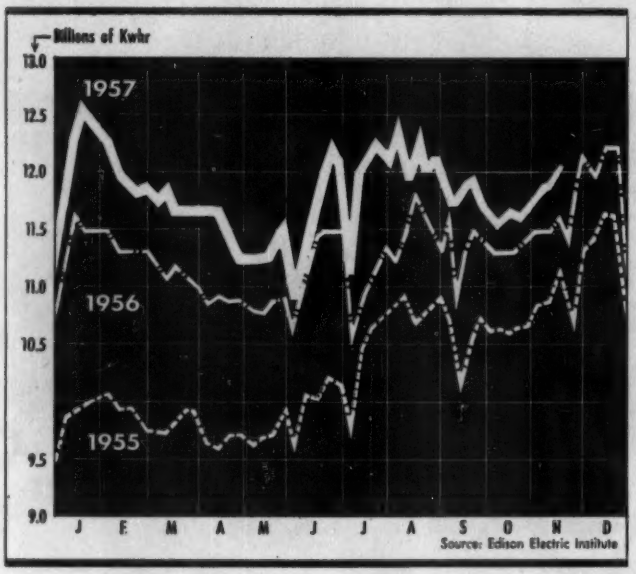
But don't base next year's outlook on the 4th quarter fizzle. Things look less bleak when you study the three major sectors of the economy—business, government, consumers. There will be much less of an adjustment than took place in the mild recession of 1954.

Business investment is slated to decline by about 7% in '58—which is slightly more than the '53-54 cutback. But there's one big difference. In 1953 there was also a heavy build-up of inventories followed by a drastic liquidation in later months. This year, by contrast, business has been keeping its inventories at manageable levels. There may be some cutbacks in '58, but nothing on the scale of the prolonged "inventory recession" of 1953-54.

Defense spending offers another contrast with the '54 adjustment. If anything's clear in the current outlook, it's that defense cuts over the next few months will be small and temporary. Even a maximum cut—say $2-3 billion—wouldn't come anywhere near the $11 billion cutback in military outlays which jolted the economy in the post-Korean period. And by the end of '58, the missile program will have pushed defense spending to a new record.

Last but not least come consumer expenditures, which will keep on rising throughout '58. Prospects now are that consumers will spend some $291 billion next year—up 3% from '57. That's not a real consumer boom, but it's enough to cancel out all the other adjustments with some left over to spare.

STATISTICS



OUTPUT

Week ended November 23, 12,136,000,000 Kwhr Up 6.1%

Per Cent Change From Previous Year

	Nov. 9	Nov. 16	Nov. 23
Total U. S.	+3.4	+3.1	+ 6.1
New Eng.	+2.6	+2.0	+ 6.7
Mid. Atlan.	+2.1	+1.3	+ 6.2
Cent. Ind.	+1.6	+1.8	+ 6.2
West Cent.	+5.9	+4.9	+ 9.3
Southeast	+4.0	+4.0	+ 3.7
South Cent.	+6.8	+6.0	+ 8.2
Rocky Mount.	+2.4	+1.7	+ 5.1
Pacific			
NW	+3.1	+2.9	+ 3.4
SW	+6.8	+6.5	+10.8

Seasonally Adjusted Index 227.1
Week Ago 226.1
Year Ago 221.6

Atomic Energy Commission requirements—1,050,000,000 Kwhr (Electrical World estimate). Excluding AEC, output increase was 7.5%

Power Statistics . . .

		Latest Month	Preceding Month	Year Ago	Annual Change %
Capacity	Sept.	126.24	125.75	118.66	6.4
Peak—Class 1 Systems.. million kw....	June	104.6	97.8	97.2	7.6
Estimated Dec. '57 Peak.	Aug.	113.0	113.2	114.6	−1.4
Production—billion kwhr.....	Sept.	51.57	55.45	48.82	5.6
Hydro.....		9.28	10.03	8.96	3.6
Fuel.....		42.29	45.42	39.86	6.1
Sales—billion kwhr.....	Aug.	49.79	48.09	46.24	7.7
Residential.....		13.05	12.59	11.60	12.5
Commercial.....		8.76	8.54	7.94	10.3
Industrial.....		25.06	24.07	23.93	4.7
Other.....		2.93	2.88	2.77	5.8
Fuel Consumption.....	Sept.				
Coal—million tons.....		12.75	13.33	12.45	2.4
Oil—million barrels.....		5.64	5.79	5.20	8.5
Gas—billion cu ft.....		137.60	160.96	124.63	10.4
Net Income Class A & B Co's $—million.....	Sept.	116.13	108.86	108.33	7.2
Residential Customers—millions.....	12 mos	46.49	46.35	45.25	2.7
Revenue per kwhr.....	ended	2.57¢	2.58¢	2.61¢	−1.5
Avg kwhr per customer.....	Aug. 31	3,104	3,082	2,915	6.5
Avg annual bill.....		$79.77	$79.52	$76.08	4.9

Business Statistics . . .

Indexes: 1947–49 = 100					
FRB Industrial Production.....	Oct.	147	145	151	−2.6
ENR Construction Cost.....	Nov.	154.6	154.7	147.6	4.7
BLS Cost-of-living.....	Oct.	121.1	121.1	117.7	2.9
New Orders for Machinery (1950 = 100).....	Sept.	141	136	136	3.7
NEMA Sales					
Insulation materials.....	Sept.	135	134	141	−4.3
Electric appliances.....		97	86	101	−4.0
Wholesale prices.....	Oct.				
Motors and generators.....		143.0	143.3	136.9	4.5
Transformers and regulators....		150.8	150.8	144.8	4.1
Switchgear and fuses.....		170.9	170.6	161.9	5.6
GNP—annual rate—$ billion.....	3rd qtr.	439.0	434.3	416.7	5.4

MANAGEMENT BULLETIN

FINANCE ▶ **New security issues of electric utility companies have gone "very well"** since the Federal Reserve Board cut its rediscount rate to 3%. Three such issues were taken up very quickly by the public recently. They were: $15 million first mtg bonds of Idaho Power Co; 451,894 common shares of Middle South Utilities Co, and 300,000 common shares of Florida Power & Light Co.

Electric utility common stocks listed on the New York Stock Exchange are rebounding in value at a fast clip. For the week ended Nov. 22, these operating company stocks advanced one or more points: Columbus & Southern Ohio Electric Co, Commonwealth Edison Co, Florida Power Corp (leading the way with a $3 a share increase to close at 54¼ as compared with a 1957 high of 59¾), Gulf States Utilities Corp, Houston Lighting & Power Co, Illinois Power Co, Iowa-Illinois Gas & Electric Co, Niagara Mohawk Power Corp, Ohio Edison Co, Oklahoma Gas & Electric Co, Public Service Co of Colorado, and Public Service Electric & Gas Co. The electric utility holding companies adding a point or more were: American Gas & Electric Co, Central & South West Corp (registered the largest increase, gaining 2⅝ to hit 39⅜ as compared with a 1957 high of 43⅛), and Texas Utilities Co.

CALECTRIC ▶

Pacing a lightning-fast population growth, California Electric Power Co will sink over $100 million into construction the next five or six years, Pres Carl C. Ernst told the New York Society of Security Analysts recently. Population soared 222% the last 26 years in Calectric's service area (San Bernardino-Riverside) as compared with the national average of 35%. Electric revenues shot up 11.9% compounded annually the last decade, and kwhr sales should multiply 11% annually the next five years, reaching a 1962 mark 87% over last year's. Plant is doubling every six years, Ernst says. (A study last spring predicted a five year schedule.) Calectric will spend $25 million next year, the same in '59, and another $50 million the following three or four years. The company has already acquired plant sites to cover the next 20 years' growth. To finance this expansion, Calectric will draw $20-25 million from internal sources, $75-80 million from the sale of new securities.

Planning to offer more securities on the market at the start of next year, Calectric is striving to boost its rate of return. If the rate increase now before the California Public Utilities Commission goes through, Ernst says, earnings could rise by 10¢ a share. He expects earnings to hit $1.10 a share in 1958. This compares with 97¢ a share for the 12 months ended Sept. 30.

One good omen for better earnings is the recent 13.2% rate increase won by Calectric's wholly owned Mexican subsidiary, Industrial Electrica Mexicana. Operating economies also bode well. In '48 the payroll consumed over 22% of gross revenue, took only a 14.1% slice this year. And system gross kwhr losses have dropped from 17.5% of generation in '47 to 10.5% today. Ernst attributes this saving primarily to better generation load center locations and higher line voltages.

Charting future demand patterns, Ernst foresees industrial revenues holding its present 24% share. Water conditions on the Colorado are so good, he reports, that next year should see secondary power available.

RATES ▶ **Saying that present rates are "inadequate, unreasonably low, and confiscatory"** when considered with Wisconsin Electric Power Co's operating expenses, investment, and the value of its property, Chairman G. W. Van Derzee asks for a rate

increase. The specific amount was not included in the petition. Company claims it would be unable to raise additional capital on a "favorable basis" without obtaining an increase in rates that would provide a reasonable return.

Power rate hike plot is charged. Tennessee Gov Frank Clement, addressing the 20th annual meeting of the Southwest Corp in Louisiana recently said private power companies, called "private enterprise" under the Eisenhower administration, have moved into the Tennessee Valley to "liberate us from low electric rates." He also charged that power resources were also being looted of their choicest sites by private power firms.

CONSTRUCTION ▶ **Hydro Electric Power Commission of Ontario has changed its rural policy** as follows:

- Farm line extensions will be built free for two thirds of a mile from existing lines instead of one third as at present.
- Rural customers in high density residential areas will get a new third block of 500 kwhr at 1.1¢ a kwhr with the normal 10% discount for prompt payment.

Mecklenburg Electric Cooperative, Chase City, Va., asks FPC for a preliminary permit to build a 34,500 kw hydro project on the Roanoke River and Whipping Creek in Halifax, Campbell, and Pittsylvania Counties, Va.

PENSION PLANS ▶ **There is a temporary loss of interest in "variable annuities"** due to the high bond interest rates which, in many cases, equalled or exceeded dividend yields on leading stocks. Now that the Federal Reserve Board indicates a "softening" in its "hard money" policy, common stocks may be expected again to yield more liberally than high grade bonds, reflecting the traditionally greater risk involved in equity investments. This should stimulate consideration of this interesting pension technique.

Legislation in New York and New Jersey to permit this type of annuity to be sold by insurance companies remains stymied with small prospects of quick action. But the "variable annuity" principle can legally be applied to pension plans of utilities under existing laws. One reason this type of plan merits serious consideration is that it should reduce the cost of the plan to the company.

Higher income normally to be expected over long periods on common stocks as compared with bonds should result in accumulating a total pension fund in the desired amount with a smaller aggregate amount of contributions to the plan. So far this arrangement seems to have restrained companies from adopting the plan despite its apparent advantages, but as common stocks improve their income position in relations to bonds, more companies may decide to take the plunge.

AREA DEVELOPMENT ▶ **"The Improved Pennsylvania Tax Climate" booklet** has just been released by the Pennsylvania Chamber of Commerce. It explains major steps which have been taken by the 1957 session of the General Assembly to create tax conditions favorable to new industry and the expansion of established industries. For copy, write: William R. Davlin, secretary, Commonwealth of Pennsylvania, Department of Commerce, Hershey, Pa.

ACQUISITIONS ▶ **Cincinnati Gas & Electric Co has bought the municipal system at St. Bernard** for $715,000. Company was granted a 25-year franchise.

Northern States Power Co has purchased the Wisconsin Hydro Electric Co. It will be operated as a division of NSP and Reuben Christensen will be division manager. WHE's Pres Rufus Houger has retired. F. H. Scholl has become division accountant and E. H. Nelson chief engineer.

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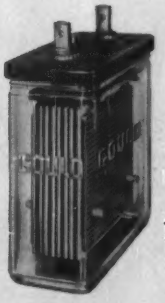

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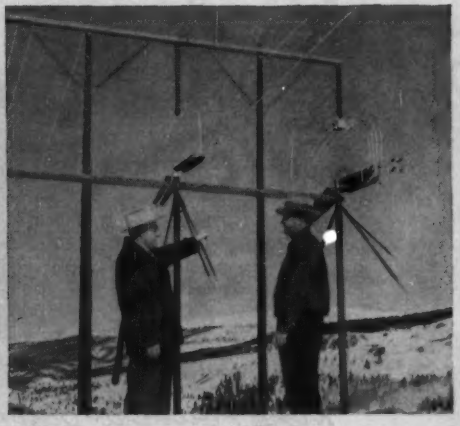
Alcoa Field Advisors Help You Speed

Operation of new 12A lightweight Alcoa Compressor is explained by field advisor Ralph Huston (left) while making a call in the field.

On the spot to check stringing of Alcoa ACSR, Alcoa field advisor Bill Rice (left) first discusses the installation with the job foreman.



Sound, helpful advice is Alcoa field advisor Jim Sunderland's (left) stock in trade. Stringing crews welcome his solid experience on any job.

Construction, Reduce Line Costs

If you're talking transmission, distribution or substations . . . Alcoa field advisors are available to help you in three important ways.

INSTALLATION HELP . . . at the job site . . . to advise construction crews on the correct application of conductors, accessories and tools . . . to help solve special problems arising from terrain or type of erection equipment.

CONSULTATION . . . In the design stage, their advice on construction methods and equipment for installing Alcoa® Conductors and Accessories can be invaluable.

PRODUCT IMPROVEMENTS . . . From their detailed reports, written and passed on to both customers and Alcoa engineers, they aid in the development of even better aluminum conductors and accessories.

To bring you this extra service . . . at no extra cost . . . Alcoa has located field advisors at strategic points throughout the United States.

Each Alcoa field advisor, before he can be considered for appointment, has had many years of experience in conductor installation and maintenance. Before being assigned to his own territory, the new advisor spends several months with other Alcoa advisors to find out firsthand how he can be of greatest service to utilities and contractors. Later, frequent refresher courses keep him constantly up to date.

If you don't already know him, you'll find that your Alcoa field advisor is a competent, pleasant, helpful man . . . full of money-saving suggestions about stringing and sagging, welding aluminum or any of a host of important considerations in modern conductor installation. Just specify Alcoa Conductors and Accessories for your next installation and tell the Alcoa salesman you'd like the field advisor to drop around. You'll find him sincerely interested in your problems . . . and well qualified to advise you on them.

◀ On a rugged mountainside, Alcoa field advisor Shorty Lowe (left) makes a few suggestions on tackling the tough right of way that lies ahead.

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Alternate Monday Evenings

Field advisor Bill Colegrove spends a day checking up on some Alcoa ACSR, newly installed by a Midwest utility.

At a utility substation, field advisor Hank Meece (right) discusses the proposed addition of some new aluminum tubular bus.

Snowshoes are standard equipment for field advisor Bob Hyde (right) as he inspects Alcoa ACSR covered with frozen snow.

Huge Stator Rumbles through 'Frisco Streets

What is believed to be the heaviest haul in San Francisco drayage history took place recently when a 455,000-lb stator for a 165-Mw generator was moved from Southern Pacific's Bayshore railway yards to Pacific Gas & Electric Co's Hunters Point Plant.

Bigge Drayage Co, with a crew of 14 men, transported the equipment over 6 miles of highway. To do the job, Bigge used a total of 138 wheels on a series of truck-tractors. The main unit consisted of a truck-tractor with a double goose-neck low-bed with 42 wheels carrying the front bolster, and the rear bolster resting on four dollies with a total of 56 wheels. In addition to the main unit, there were two extra tractors pulling and two tractors pushing with a combined total of 40 wheels. The hauling unit was 111 ft in over-all length and 21 ft wide at the rear. Over-all length of the hauling unit and the pushing and pulling tractors was 160 ft. The movement took 9 hr and was escorted by both San Francisco police and California Highway Patrol officers.

Before it arrived in San Francisco, the stator had a five-week railway trip from General Electric Co's plant at Schenectady, N. Y., to San Francisco. Bigge crews then spent several more days removing the stator from the railroad car and mounting it on the hauling unit.

The stator will become part of the fourth turbine-generator being installed as part of PG&E's $21 million expansion at Hunters Point. Total plant capacity will be 427,000 kw. The turbine-generator will be out-of-doors, with the boilers covered by an open-side umbrella-type structure. Throttle steam condition is 1800 psi, 1000/1000 F.

Lower Sound Level Is Target of NEMA Standard

General purpose, dry type transformers, built in accordance with newly revised standards of the Specialty Transformer Section of the National Electrical Manufacturers Association, will operate at considerably lower sound levels than the units built according to previous standards.

This was the consensus of member companies affiliated with the Section in approving the revised standard at a meeting in connection with NEMA's 31st annual convention. The revision subsequently was approved by the NEMA Codes and Standards Committee.

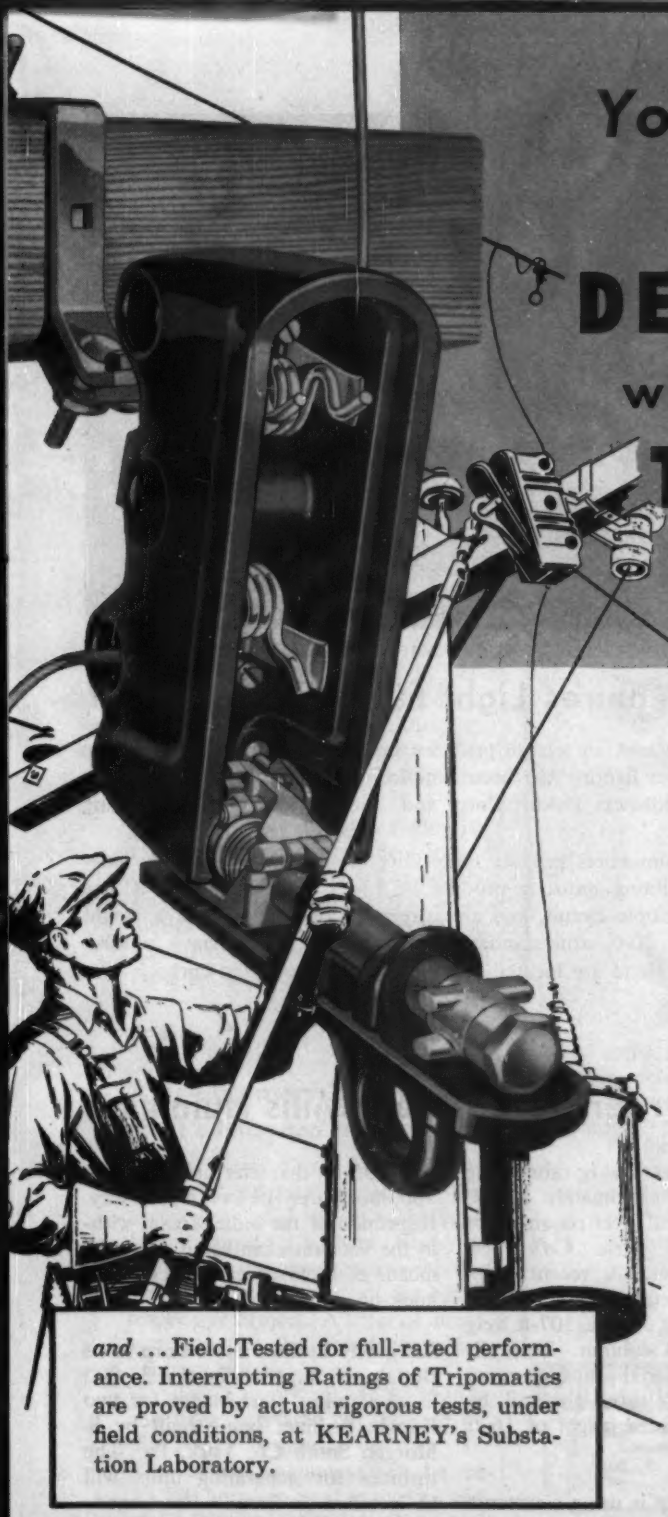
The development of quieter operating transformers meets requirements of architects, construction engineers and building occupants for high quality electrical power equipments which are comparatively noise-free.

Transformer Rating, KVA (600 v or less)	Average Sound Level Decibel
From 0 — 9	45
Over 9 — 30	50
Over 30 —112½	55
Over 112½—167	60
Over 167 —300	62

Accompanying table lists the kva ratings of such transformers, when produced in line with the revised NEMA standards, and the average sound level of each in decibels.

Section members recommended that dry type transformers be located on a solid foundation or vibration absorbing mounting, and as far as possible from sound reflecting surfaces. When properly installed, normal operating sound will not be amplified by reflected waves.

(*More M&M on page* 96)



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Hanger and contacts attached by *bolting*—eliminates all possibility of loosening or pulling out.

Three-point shock absorber consists of upper and lower contact springs and a tripping spring. The cable of the fuse link is automatically clamped under predetermined constant pressure without the use of thumbscrew or winged nut.

Movement of gas from lower contact to upper contact is restricted by means of interior box construction and collar around tube, preventing internal short circuits.

All live parts completely enclosed—door assembly is de-energized when in open position.

and . . . Field-Tested for full-rated performance. Interrupting Ratings of Tripomatics are proved by actual rigorous tests, under field conditions, at KEARNEY's Substation Laboratory.

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L-M Luminaires Light Fulton's Downtown

Downtown is now an area of pride for residents of Fulton, N. Y. Here fluorescent street lighting has been installed. It is the first on the system of Niagara Mohawk Power Corp and one of the first in Upstate New York.

Four-lamp luminaires provide uniformity of light on streets and sidewalks. The lighting units, a product of Line Material Industries, are on a 120-v multiple circuit, and are suspended on 6-ft arms at a height of 27 ft. The 30-ft iron standards were re-used. They have a 90-ft nominal spacing and are located opposite each other at the curbs.

Utility Orders Keep Steel Mills Humming

Bethlehem Steel Co is fabricating and erecting approximately 14,000 tons of structural steel required for Philadelphia Electric Co's new Eddystone plant. A recent shipment from Bethlehem's Steelton, Pa., plant was a 31-ton, 107-ft long fabricated steel column. This all-welded girder for the turbine room when shipped cleared the rail by 10.5 in. and had a height of 16 ft above the rail.

U. S. Steel Corp is using a vacuum casting method to produce castings at the Duquesne (Pa.) Works for huge turbine and generator shafts. This method extracts harmful gases from the molten metal prior to formation of the ingot. This in turn is expected to increase ductility in the forgings and to remove their sensitivity to internal ruptures. Ingots up to 95-in. diameter and weighing 360,000 lb may be cast in this way. Inspection of the ladle stream within the vacuum chamber is made by means of a closed circuit television hook-up.

Allegheny Ludlum Steel Corp at its Buffalo, N. Y., foundry cast 35,000 lb of stainless steel blades for two Kaplan turbines being built by S. Morgan Smith Co, York, Pa. The turbines for generating units will be installed on Brazil's Rio Grande River next year.

U. S. Aluminum Production

Primary aluminum production in the United States totaled 133,759 tons, according to the Aluminum

Association, New York. The amount was an increase of 4,482 tons over September, but a decrease of about 15,360 tons from October, 1956. Total production for the year through October amounted to about 1,372,653 tons, down by about 13,120 tons from 1,385,775 tons for same period in 1956.

Silver Plated Aluminum Bus Manufactured by Reynolds

Silver plated aluminum bus conductors are available commercially by development of a new manufacturing process.

The process, developed by the metallurgical research laboratories of Reynolds Metals Co, Louisville, Ky., is inexpensive enough to provide silver plated aluminum bus at substantial savings, according to Jack C. Warford, manager of the electrical equipment market for the company.

Silver plating aluminum bus, he explained, makes it practical to accomplish connections by relatively simple soldering and brazing techniques and eliminates the need for special preparation of contact surfaces for bolted connections.

Allis-Chalmers Gets Nod for 12 Niagara M-Gs

The New York State Power Authority announced that it has accepted the bid of Allis-Chalmers Manufacturing Co, New York, to furnish 12 motor-generators for the Tuscarora power plant of the Niagara Power Project. A letter of intent was issued to the manufacturer for contract No. NP-2.

Allis-Chalmers bid of $7,135,000 was lowest of three bids opened by the Power Authority on Oct. 30. The motor-generators will be of 37,500 hp when used as motors and of 25,000 kva capacity when used as generators.

Allis-Chalmers and S. Morgan Smith Co in a joint bid were notified of the Power Authority's acceptance by letter of intent to furnish the 12 hydraulic pump-turbines for the motor-generators. (EW, Oct. 28, p. 108).

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CONSECO is equipped and thoroughly qualified by 30 years experience to repair, re-tube or re-build any type of tubular equipment, our own or any other manufacture. Extensive facilities and personnel handle emergency assignments on the job or in our own shops. A CONSECO re-built heat exchanger is usually a better product than the original equipment because it benefits, during repairs, from our familiarity with all types of heat exchangers and of features that help achieve longer, trouble-free, more efficient operation.

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to increase efficiency and cut power costs
For further data consult Chemical Engineering Catalog pages 559-562

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Descriptive Bulletins Sent Promptly

Boston Ed Promotes Two to Vice President

GEORGE A. ORROK

Charles F. Avila and George A. Orrok have been elected vice presidents of Boston Edison Co.

Avila, formerly assistant to the president and for recent months vice president-engineering and construction, has been named vice president and assistant general manager. Avila, who will headquarter in Boston, previously held various engineering and executive posts.

Orrok, heretofore superintendent of engineering and construction, has been made vice president in that field, succeeding Avila.. During his 27-year career at Boston Ed, he has held posts in the steam plant and production departments.

In other promotions, Thomas J. Galligan, Jr, was made assistant to the president; R. M. Kelmon, assistant treasurer.

CHARLES F. AVILA

SEGC Advances Burnett

Southern Electric Generating Co has announced the recent appointment of Andrew E. Burnett as operating manager of the company. He will assume his new position on December 2.

Burnett's new responsibilities will center on the $150-million, 1,000-Mw steam plant now being constructed near Wilsonville, Ala. Power output from the plant will be purchased in equal amounts by Alabama Power Co and Georgia Power Co, joint owners of SEGC.

Burnett's experience in the utility field dates back to 1930, when he joined Alabama Power upon graduating from Ala. Polytechnic Institute. Since then he has served as lineman, local and district manager, division engineer, production engineer, and superintendent of generating plants at Gorgas, and manager of employee relations.

M. L. KAPP

Kapp Rises to Top IPC Post

M. L. Kapp, president of Interstate Power Co, has been elected to the position of senior officer of the Dubuque, Iowa, Utility. He assumes the duties of the post left vacant by the recent death of B. F. Pickard, former chairman of the board. The post of chairman of the board has been consolidated with that of the president.

In addition, C. A. Hummel has been elected a member of the utility's finance committee. Hummel is executive vice president and second senior officer of IPC.

When choosing a premium power cable . . .

How much choice do you <u>really</u> have?

Cable may *look* alike—but you can find many differences in jackets and insulating compounds. And you want only the *best* cable for your operating conditions.

That's why it's important to choose your cable from a manufacturer who offers you a real choice of modern cable materials.

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Only three major companies give you a choice of *either* oil-base or butyl-base insulation. Rome Cable is one of these three and offers a choice of Rozone A (butyl-base) and Rozone (oil-base) insulations.

And, in addition, Rome can offer you a *polyethylene* insulation for high voltages.

You can match your operating needs more closely with cable insulation that puts the emphasis on what you want most—resistance to heat, moisture, ozone cutting, or any combination of properties. You can be sure of this choice when the cable is made by Rome Cable.

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In modern jacket materials, too, the same kind of freedom works to your advantage. You get a choice, with Rome Cable, of Roseal (special flame-retardant polyethylene); Roprene (a Rome-developed neoprene compound for use with rubber insulations); Rolene (polyethylene); and several other high-quality jacketing compounds. Each has its own advantages, depending on your requirements.

Bring your cable problems to Rome

When you discuss your premium cable requirements with your Rome Cable representative, you can count on his recommending the *right* cable for you. No matter what type of cable you choose, take advantage of Rome's ability to offer you a *real* choice.

For more information on the choice you get with Rome's power cable, contact him now—or write to Department 713, Rome Cable Corporation, Rome, New York.

ROME CABLE

CORPORATION

WILLIAM M. WALLACE

A-C Elevates Wallace to VP

Newly elected vice president of Allis-Chalmers Manufacturing Co is William M. Wallace, general manager of the company's General Products Division since June of 1955.

Also elected vice presidents were P. F. Bauer, managing director, International; and E. J. Mercer, general manager, Construction Machinery Division. A. D. Dennis has been named secretary of the firm.

Wallace has been with the company since 1937, when he started as a sales representative in the Denver and Pittsburgh district offices. Then, after a post in the processing machinery dept, he became assistant to the VP of the Industries Group in 1951. Since then he has been assistant manager, power department, and manager, processing machinery department.

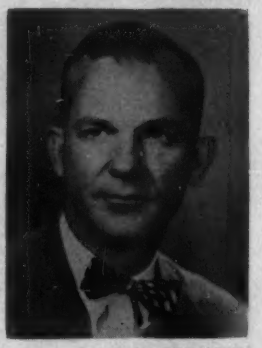
J. E. CORDELL

Two Get VP Titles

In two important organizational changes, Southern States Equipment Corp promoted J. E. Cordell to vice president-sales and T. A. Burdeshaw to vice president-engineering.

Cordell has been assistant sales manager and sales manager since joining SSE in 1953. An engineering graduate of St. Johns University, he was once with Ebasco Services, Inc.

Burdeshaw, engineering manager since 1954, came to SSE from Birmingham Electric Co in 1941. He is former sales manager at SSE.

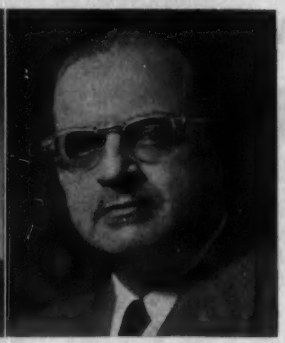


T. A. BURDESHAW

R. K. TURNER

C. M. BLAIR

R. D. GLENN



L. K. MERRILL

Bakelite Makes Four Executive Appointments

Recently elevated by Bakelite Co, a division of Union Carbide Corp, were R. K. Turner, who was elected president; and C. M. Blair, R. D. Glenn, and L. K. Merrill, all promoted to vice president.

Turner, vice president of Bakelite since 1952, succeeds G. C. Miller, now president of UC Realty Co. Before his association with Bakelite, Turner had been with UC Chemical for almost 30 years.

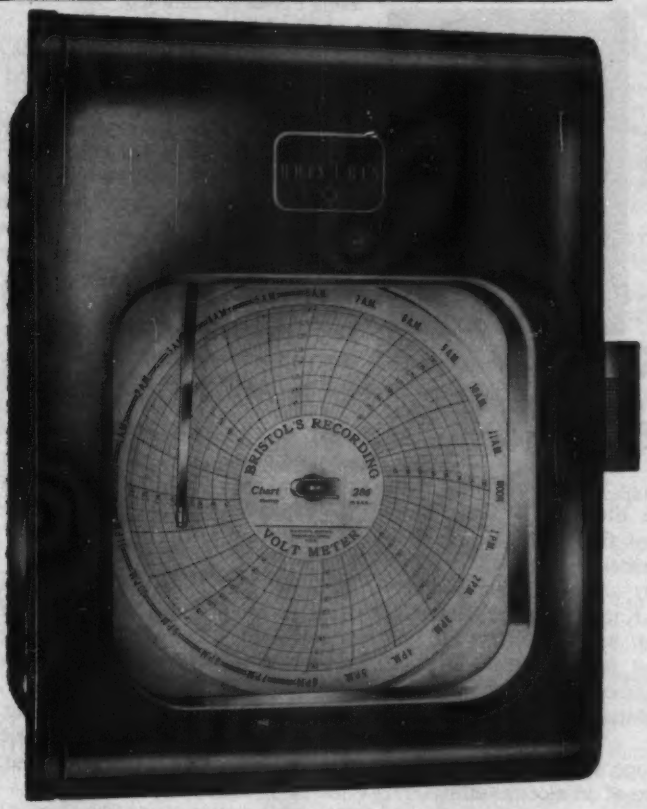
Dr Blair, who becomes vice president, planning, comes to his new post after experience in UC chemicals and polyolefins components.

Glenn, has been named vice president-development. His previous career with UC has been in the fields of chemicals and vinyls.

Merrill, as VP-technical, will have staff responsibility for patents and licenses. He is former VP-product and process development.

WHAT'S NEWS AT BRISTOL . . .

How do you pick the right recording ammeter or voltmeter?



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Why Bristol? Mainly because for sheer accuracy the Bristol Recorders can't be topped. Among the reasons for that are:

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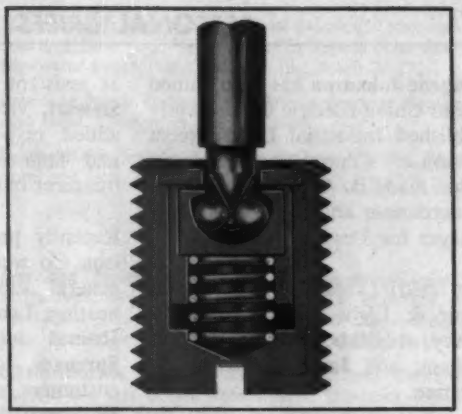
2. Extremely high torque gradient.
3. Temperature compensated.
4. Shock-proof moving element mounting.
5. Leveling of instrument not critical.
6. Continuously legible recording of sudden changes – up to full scale value.

Also, Bristol's Series 500 Voltmeters and Ammeters are designed for easy use, with dust- and moisture-proof cases; quick-set chart hub for each chart changing; and snap-on chart plate.

Models offered that comply with ASA Specification C39.2.

Want more facts? Write for Bulletin E1111 to the Bristol Company, 116 Bristol Road, Waterbury 20, Conn. 5.19

SINGLE AND TWO-PEN PORTABLE BRISTOL RECORDERS are offered in two models: one chiefly for portable pole mounting and the other for general portable service.



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BRISTOL

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AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

Fisher Named to Head Johns-Manville

In a realignment of executive responsibilities, at Johns-Manville Corp, Adrain R. Fisher has become chief executive officer and Clinton B. Burnett was elected to the new office of executive vice preisdent.

Their appointments follow the retirement of Leslie M. Cassidy, chairman. He will continue as director and consultant.

Fisher also continues as president and director, offices he has held since 1951. He has been a senior officer for 20 years.

Burnett was designated as 'principal assistant in the administration of the firm."

Eta Kappa Nu Honors AGE Engineer

Glenn W. Stagg, senior engineer with American Gas & Electric Corp, has been selected as one of the nation's three outstanding young electrical engineers for 1957.

Stagg has won an Honorable Mention award from Eta Kappa Nu, national electrical engineering honor society. In his present AGE post he has been concerned with a large number of techno-economic studies of individual and interconnected power systems.

He is the first one who received an award while an employee of an electric utility.

PERSONAL BRIEFS

J. Eugene Johanson has been named to head Union Electric Co's recently established Industrial Development Division . . . Central Power & Light Co has made **D. A. Mason** manager at Jourdanton and **J. D. Robertson** manager for Devine.

New district managers at Texas Power & Light Co are **Paul H. Harvey,** at Hillsboro; **V. L. Barnett,** Bonham; and **James C. Ragsdale,** Palestine.

Kentucky Utilities Co has named the following to serve as members of its newly created executive committee of the board of directors; **F. I. Fairman,** company president; **Arthur A. Tuttle,** secretary; **Squire R. Ogden,** and **Ralph D. Stevenson.** In the company promotions, **E. Earl Clark** was elected treasurer; **Elbert D. Adams** was made assistant treasurer, in addition to his present post as assistant secretary; and **A. Clay Stewart,** vice president, was given added responsibility for property and finances. Tuttle resigned as treasurer but remains secretary.

Recently promoted at Detroit Edison Co were **Glen D. Winans,** to general superintendent of central heating; **Leo F. Collins,** to assistant general superintendent; **Carl B. Sprenger,** to supervising engineer-customers' steam service; and **Carl W. Signor,** to personnel coordinator and technical engineer.

Public Service Co of Oklahoma has advanced **Earl Finch** to assistant to the Okmulgee area manager and **Bill J. Harris** to Okmulgee area new business manager.

John R. Bruch is new manager of Cleveland Electric Illuminating Co's eastern sales department . . . **Elizabeth Fitzgerald** was recently made home service counsellor by Black Hills Power & Light Co.

In a recent series of promotions, Carolina Power & Light Co named **Kermit Allison** as Wadesboro district manager; **Roy Burch** as assistant district manager at Asheville; **Roy Wright** as Canton district manager; and **Fred Hutchinson** as Hazelwood manager.

Indiana Electric Assn's new officers are president, **C. K. Graham** of Southern Indiana Gas & Electric Co; and vice president, **Edmond W. Hebel,** Public Service Co of Indiana.

Paul A. Christenson has been appointed by Square D Co to assume the new post of works manager in the expanded operations of the Industrial Controller Division.

Philco Corp's **Donald G. Fink** has been elected president of Institute of Radio Engineers for 1958 . . . New president of RLM Standards Institute, Inc, is **William P. Lowell, Jr,** of Sylvania Electric Products, Inc. **J. H. Fall, III,** of Benjamin Electric Mfg Co was elected vice president.

The General Atomic Division of General Dynamics Corp has as its new chief research and development engineer **Dr Peter Fortescue,** British engineer who contributed to the development and construction of the Calder Hall power reactors.

OBITUARY

Ernest W. Allen, 71, vice president of Lynn (Mass.) Gas & Electric Co, died in Lynn recently. A former state representative, he was with LG&E for 45 years.

William R. Putnam, 81, a retired director and general consultant of Ebasco Services, Inc, died recently following a long illness.

Gerard Swope, 84, former president of General Electric Co, died of pneumonia recently at his New York City home. Swope, who was president of GE for 20 years, joined the company in 1893 as a helper at $1 a day. He was a past president of National Electrical Manufacturers Association.

MEETINGS CALENDAR

DECEMBER

Edison Electric Institute — Accounting Division Electronics Seminar, sponsored jointly with AGA, Sheraton Cadillac Hotel, Detroit, Mich., Dec. 2-4; Electric Space Heating and Air Conditioning Committee, Cincinnati, Ohio, Dec. 4-6; Industrial Relations Committee, sponsored jointly with New England Personnel Group, Sheraton Plaza Hotel, Boston, Mass., Dec. 5-6; Market Research Committee, Louisville, Ky., Dec. 5-6; Accounting Division Depreciation Committee, sponsored jointly with AGA, Lord Baltimore Hotel, Baltimore, Md., Dec. 9-10; Commercial Cooking & Water Heating Committee, Detroit, Mich., Dec. 12-13; EEI-AGA Customer Activities Group, Accounting Employee Relations Committees, Netherland Hilton Hotel, Cincinnati, Ohio, Dec. 12-13.

American Mining Congress—Annual Membership Meeting, New York, N. Y., Dec. 2.

Interstate Power Club—Hotel Martinique, New York City, Dec. 9.

Electric Companies Public Information Program — Steering Committee, Palmer House, Chicago, Ill., Dec. 10.

Electric Companies Advertising Program—Management Group, Palmer House, Chicago, Ill., Dec. 12.

Electronic Industries Association—Conference on Maintainability of Electronic Equipment, University of Southern California, Los Angeles, Calif., Dec. 18-19.

JANUARY—1958

International Home Furnishings Market—Including Appliance Show, The Merchandise Mart, Chicago, Illinois, January 6-17.

Edison Electric Institute—Home Service Committee, Chicago, Ill., Jan. 8; 2nd Annual LBE National Womens' Conference, Edgewater Beach Hotel, Chicago, Ill., Jan. 9-11; Industrial Relations Committee, Mayflower Hotel, Washington, D. C., Jan. 16-17; Dealer Coordination Committee, EEI Headquarters, New York City, Jan. 30-31.

Instrument Society of America—Boston Section, Yankee Instrument Fair & Symposium, Hotel Bradford, Boston, Mass., Jan. 14-15.

Industrial Heating Equipment Association — Penn Sheraton Hotel, Pittsburgh, Pa., Jan. 27-28.

American Society of Heating and Air-Conditioning Engineers—64th Annual Meeting, Penn-Sheraton Hotel, Pittsburgh, Pa., Jan. 27-29.

Home Improvement Products Show—Hotel Sherman, Chicago, Ill., Jan. 27-29.

FEBRUARY

National Association of Purchasing Agents—Public Utility Buyers Group Mid-Winter Meeting, Sheraton Hotel, Philadelphia, Pa., Feb. 2-4.

National Rural Electric Cooperative Association—Annual Meeting, Memorial Auditorium, Dallas, Tex., Feb. 2-6.

Edison Electric Institute — Prime Movers Committee, Penn Sheraton Hotel, Pittsburgh, Pa., Feb. 3-5; Industrial Power & Heating Group, Netherland Hilton Hotel, Cincinnati, Ohio, Feb. 6-7; EEI-AGA 1958 Conference Final Planning Meetings, Ben Franklin Hotel, Philadelphia, Pa., Feb. 6-7; Electrical Equipment Committee, Dayton Biltmore Hotel, Dayton, Ohio, Feb. 10-11; Transmission & Distribution Committee, Lord Baltimore Hotel, Baltimore, Md., Feb. 11-12; Meter & Service Committee, Sheraton Hotel, Philadelphia, Pa., Feb. 17-19; Industrial Relations Committee, (joint dinner with AGA Personnel Practices Committee) AMA Mid-Winter Personnel Conference, Feb. 20.

• **Industrial Electrification Council**—National Industrial Heating Conference, Netherlands Hilton Hotel, Cincinnati, Ohio, Feb. 3-6.

American Institute of Electrical Engineers—Winter General Meeting, Statler and Sheraton-McAlpin Hotel, New York City, Feb. 3-7.

Missouri Valley Electric Association—Industrial & Commercial Sales Conference, President Hotel, Kansas City, Missouri, Feb. 6-7.

NATIONAL ELECTRICAL WEEK WILL BE OBSERVED FEBRUARY 9-15.

American Public Power Association—Engineering & Workshop Meetings, Chattanooga, Tenn., Feb. 13-14.

• **National Society of Professional Engineers**—Spring Meeting, Michigan State University, East Lansing, Mich., Feb. 13-15.

American Institute of Mining, Metallurgical, and Petroleum Engineers—Annual Meeting, Hotel Statler, New York City, Feb. 16-20.

MARCH

Southern Safety Conference, Inc—Exposition, Peabody Hotel, Memphis, Tenn., March 2-4.

Lighting Lamps and Electrical Manufacturers Salesmen's Association—First National Lighting Exposition, Coliseum, New York City, March 9-12.

Nuclear Congress—Co-sponsored by American Society of Mechanical Engineers and the Engineers Joint Council, International Amphitheater, Chicago, Ill., March 16-22.

National Association of Corrosion Engineers—Annual Conference & Exhibition, Municipal Auditorium, San Francisco, Calif., March 17-21.

American Society of Mechanical Engineers—Management Conference Committee, Hotel Somerset, Boston, Mass., March 19-20.

Edison Electric Institute—Industrial Relations Committee, Headquarters, New York City, March 20; Annual Sales Conference, Edgewater Beach Hotel, Chicago, Ill., March 24-27.

American Power Conference—20th Anniversary Meeting, Sherman Hotel, Chicago, Ill., March 26-28.

Southeastern Electric Exchange—Annual Meeting, Boca Raton Hotel and Club, Boca Raton, Fla., March 31-April 2.

APRIL

American Society of Mechanical Engineers—Conference of Instruments and Regulators, University of Delaware, Newark, Del., April 1-3; Maintenance and Plant Engineering Conference, Penn-Sheraton Hotel, Pittsburgh, Pa., April 14-15.

Edison Electric Institute—EEI-AGA National Conference of Electric and Gas Utility Accountants, Shamrock Hilton Hotel, Houston, Tex., April 14-16; Industrial Relations Committee, EEI Headquarters, New York City, April 17; Accident Prevention Committee Perry Hotel, Toledo, Ohio, April 27-30.

American Welding Society—Annual Meeting and 6th Welding Show, Statler Hotel, St. Louis, Mo., April 14-18.

Missouri Valley Electric Association — Engineering Conference, President Hotel & Municipal Auditorium, Kansas City Mo., April 16-18.

Pacific Coast Electrical Association — Administrative Services Section, April 23-24.

• Additions this week.

READERS FORUM

" . . . Oil Does Not Flow Through Centre of Cables"

To the Editor:

As you can appreciate, many of our engineers follow Electrical World very closely. One of these gentlemen noted the reference to our new cable-cooling system under "News-Scope" on page 19 of the October 7, 1957, issue, and he directed it to my attention, particularly the last sentence which reads: "Insulating oil flows through the centre of each cable to act as a coolant and to keep out water."

This engineer felt there was a possibility that it could convey an impression which is not entirely accurate, and that you would wish to have the matter brought to your attention, bearing in mind the very high standard of accuracy maintained by your publication.

Actually, the oil does not flow through the centre of the cables. It is maintained at a *constant pressure* by means of two oil pressure systems. The water to cool the cables is carried in *separate* lengths of polyethylene piping laid alongside the cables.

I can readily appreciate that it is very easy to get a little "off the beam" in condensing a story of this kind and we are all very human.

I do hope you will accept these comments in the spirit in which they are offered.

William Rattray
Supervisor,
Staff Writers Section

The Hydro-Electric Power
Commission of Ontario
620 University Avenue
Toronto 2, Canada

Joint Capacity Planning

(*Continued from page* 61)

The purpose of these arrangements is to forestall duplication of existing facilities so as to permit the service of added loads at the lowest feasible cost. Joint-use arrangements covering these situations have been developed. Transmission arrangements of this sort are inherently more difficult to receive than are joint-use production arrangements because of the multiplicity of functions such as direct service of a specific load, reserve for other load areas, and interconnection between systems, that may be assigned to certain transmission lines.

In all these joint arrangements —production, transmission, interchange—the priceless ingredient of success is the mutual respect and confidence among the four parties. Sharp practices and selfish objectives have no place in arrangements of these kinds. In fact, a careful analysis will prove such tactics will be detrimental to the long-run self interest of any company.

Capacity coordinating arrangements are far from new in our industry. Most of these, however, are of the nature of some sort of deficiency charge which is applied if a given level of reserve generating capacity is not maintained. Few, if any of them, start from the grass roots of joint capacity planning from a one-system approach. Furthermore, few if any of them provide for the sharing of the capacity, energy output, and full annual cost of new steam units. Our plan goes further than any we know of in securing for a group of relatively small independent companies the bulk power economies of larger systems, without the sacrifice of their basic independence.

In closing I am glad to be able to report that we have the initial participation unit on the line in the form of Bridgeport Harbor Unit No. 1 (Fig 4). It is significant to note that the plant's actual size is 82 Mw while its probable size if it had not been in a participation unit would have been only 50 Mw (Fig 5). Our initial participation includes Connecticut Light & Power—9 Mw; Hartford Electric Light and Connecticut Power—28 Mw; and United Illuminating—45 Mw. Gentlemen, we're in business.

Speeds CB Closing

(*Continued from page* 71)

Late in the handle's descent, a pin on the hand closing cam engages the hold-up latch and rotates it counter clockwise. Meanwhile continued extension of the springs tends to force the first-stage closing cam to turn clockwise. This rotation is restrained by the left-hand roller on the roller carrier. The carrier is kept immobile by the hold-up and primary latches, until the hold-up latch's pivoting permits the carrier to slip by it.

The closing springs' pressure on the first-stage closing cam rotates the roller carrier counter clockwise about the center roller. The other end of the carrier moves upward, forcing the jackshaft cam to spin clockwise. This moves the contact arm assembly into the closed position relative to the stationary contact structure. Meanwhile the prop latch is rotated counter clockwise by the first-stage closing cam's motion. This latches the roller carrier which, in turn, holds the breaker contacts in the closed position. The operating handle, once released by the operator, returns to normal.

Tripping of the breaker by an overcurrent trip device occurs when the overcurrent armature trip screw strikes the tripper on the tripper bar to rotate it. This spinning releases the latch on the latch bar assembly and, simultaneously, allows the primary latch to rotate counter clockwise to release the support under the roller carrier. The carrier moves downward guided in the diagonal slot in the mechanism housing and under the influence of the opening springs of the breaker. The jackshaft then rotates counter clockwise, opening the breaker contacts. An auxiliary spring, pulling the roller carrier assembly to the supported position on the primary latch, returns the mechanism to the open position ready to be charged.

In manual tripping, pressure on the hand trip button on the breaker's face plate moves a link. This link cams the latch bar assembly counter clockwise, releasing the primary latch. This latch rotates in the same direction, unlatching the roller carrier and initiating the same action as in automatic tripping.

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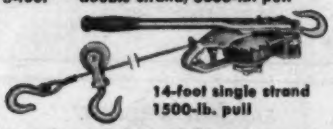

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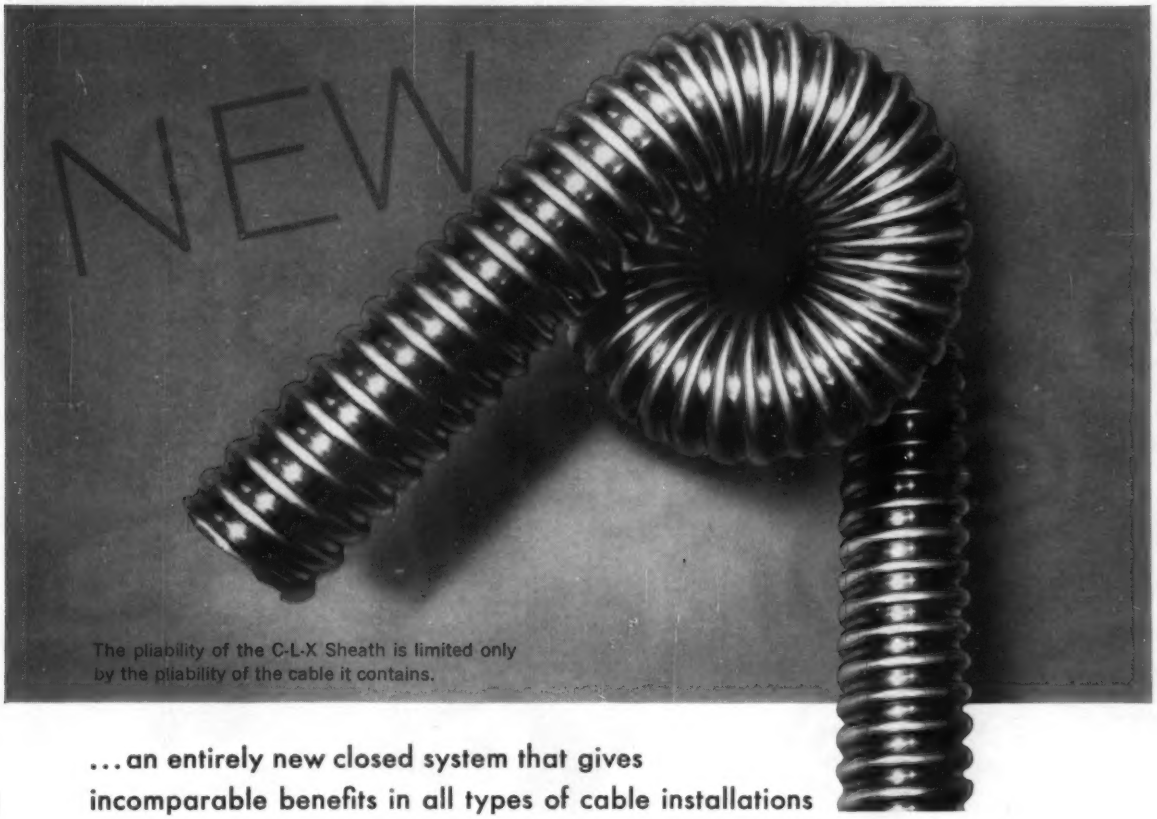

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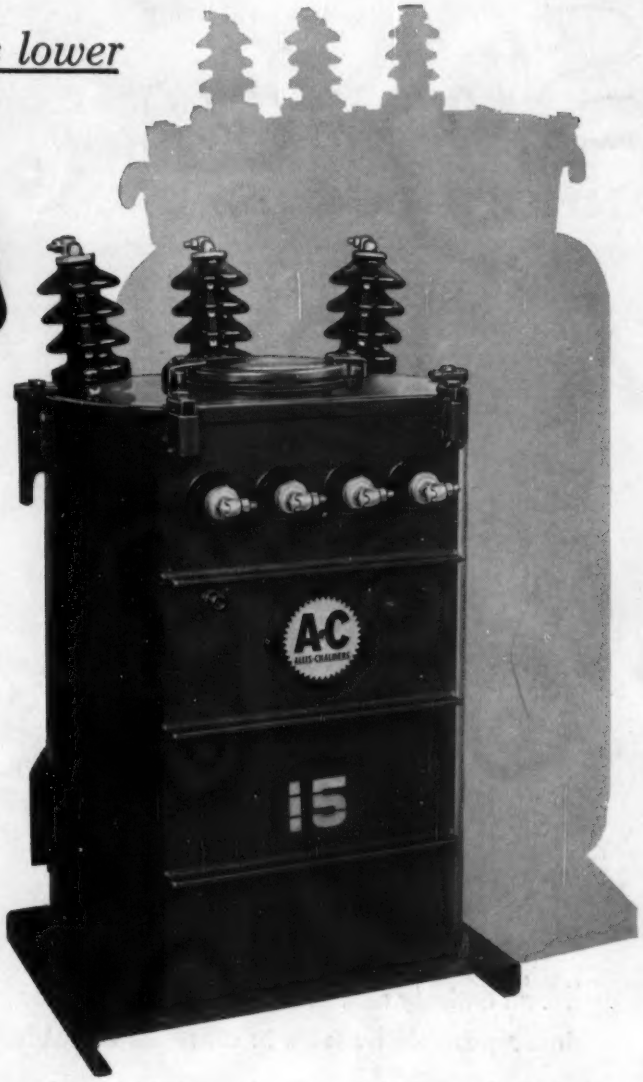

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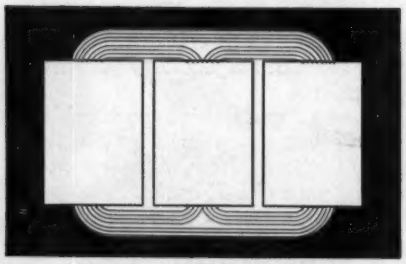

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